Boot & Shoe

Design & Manufacture.

Edward J. C. Swaysland

Boot and Shoe Design and Manufacture.

BY

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With 126 Inserted Plates.

Northampton:

PRINTED BY JOS. TEBBUTT, KING STREET AND SILVER STREET.

1905.

PREFACE.

THE production of this work is principally due to the many requests for a book containing sufficient information to explain the matters referred to in the syllabuses written by me for several Educational Bodies; its form is mainly owing to a suggestion by Mr. J. H. Legge, the Chief Inspector of Industrial Schools, that the diagrams prepared by me for the use of my students, and exhibited at the Paris Exhibition, would form a basis for the production of a Text Book of this kind. It was afterwards found that the rapid development of Boot and Shoe Manufacture made it necessary for me to produce an entirely fresh set of diagrams: this is my excuse, to my many friends, for the delay in satisfying their demands for this book.

The work is intended to meet the desires of the student, the practical workman, and the manufacturer; and, therefore, probably includes matter that each of them does not require. But, without claiming that the difficulties in the publication of a work of this kind have been entirely overcome, it is hoped that it is a more complete presentation of the modern methods of Shoe Making and Manufacture than has been hitherto attempted. Although produced for the use of students it is hoped that it will be found of service to manufacturers.

In justice to those who have so kindly and liberally assisted me in many ways, I may say that a work of this character could not be produced without the co-operation and assistance of a large number of persons. I am indebted to the whole of my staff of teachers for many valuable hints and items of information, which their practical contact with the routine of manufacture made of special value. I am glad to be able to acknowledge my indebtedness to Messrs. Bates, Bruce, Bush, Dickenson, Gilbey, Goode, Loakes, Lovell, Percival, Skinner, Ward, and Wright for much valuable assistance.

Modern manufacture and machinery are inseparable, and the representation of one without the other is of little value. The development of modern Boot and Shoe Manufacture is largely due to the competition in the production of mechanical appliances, the magnitude of which is represented in this work by the one hundred illustrations of machines produced by the British United Shoe Machinery Company; the complete Welting Plant, by the Standard Rotary Machinery Company, of Rushden; the Upper Stitching Machines, by Messrs. Singer; the complete Finishing Plants, by Messrs. Jackson and Pochin, of Leicester, and Messrs. Robinson and Co., of Kettering; the Heeling Machines, by Messrs. Collier, of Northampton; Pattern Making Tools, by Messrs. Livingston and Doughty, of Leicester; and of Lasts and Treeing Machines, by Messrs. Whitton, of Northampton, and Messrs. Mobbs and Lewis, of Kettering. The production of this work, in its present form and size, would have been impossible without the assistance of the firms mentioned.

My sincere thanks are also due to the "man of letters," Mr. Tebbutt, who kindly undertook the printing of the work, who is responsible for the arrangement of the matter, and who has done very much to reduce the apparently unavoidable errors which appear inseparable from a book of this kind. My thanks are also due to Messrs. Hoare and Cole, the "men of blocks," who have made most of the line blocks from my drawings. For these drawings I alone am responsible; many of them have been produced by me for the purpose of assisting the student in his study of this complex trade, and are more or less reproductions of my blackboard diagrams.

December, 1905. THE AUTHOR.

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Boot and Shoe Design and Manufacture.

CHAPTER I.

Historical.

AT what period man first designed covering to protect his foot from being cut by stones, pricked by thorns, or scorched by the hot sands, is buried in the utmost obscurity. The most ancient evidence appears to be the carvings upon the monuments and the clothing of the feet of mummies of Egypt. All other evidence is of comparatively recent date, and is not by any means conclusive, even as to the materials used or the fashion commonly in vogue.

It is reasonable to suppose that as man developed from the hunter to the agriculturalist, learned to weave and plait, and abandoned skins as a covering for the body, that he began to fashion his foot covering from woven materials. And that in this he would have been much influenced by the nature of the climate he was living in, and consequently while some nations found plaited straw sufficient protection, others would retain animal skin for the same use; and therefore there were in pre-historic times, as there are now, many different fashions of foot gear and many different materials used.

About 4,000 years ago, the people of Egypt appear to have worn a sandal, which was fastened to the foot by thongs passing between the great toe and round the ankle. The sole was of wood, or of thick leather, and shaped in various ways according to the period and the rank of the wearer. At a quite early date efforts were made to distinguish the different classes of people by the form of their foot gear, and consequently, as some classes obtained wealth, footwear was made in colours, embroidered with gold and studded with gems; laws were passed defining the footwear for each class, until in the time of the Romans they became so indicative of class distinction that the rank of a person could be ascertained by inspection of their feet only. These laws, revived by many nations in many ways, can be traced to quite modern times.

Probably the earliest form of shoe consisted of a wrapping of skin round the foot, the fastening together of the pieces and to the foot being by means of tendons drawn from animals. This appears to have been the nature of the foot clothing in use among the early Britons, and was still in use until recent years in some remote parts of Ireland. A representation of this shoe (Rivilin) is given upon Plate 1, copied from a specimen in the Northampton Museum. This appears to be of Scandinavian

origin, and to have been shaped by placing the foot upon a piece of raw hide, drawing a portion over the sides of the foot, and cutting away the material overlapping. The parts meeting were sewn together with tendon, and holes then cut for lacing the shoe across the instep. In method of construction the North American Moccasin differs very little from this; the difference consisting of the insertion of centre and side pieces in the place of the front seam. This moccasin principle is found in various forms all over the world, and appears to be the first development from the primitive form of shoe.

The next development was probably the extension of the insertion of the moccasin to cover the whole of the upper part of the foot and the substitution of a stout sole for the lower wrapping, forming a distinct sole. With this we have the introduction of various methods of seaming the sole to the top part, and there is not much doubt but that the first methods resulted in something similar to the modern clog, or to the veldtschœn. The ancient Egyptian appears to have understood sewing and to have attached thongs to the papyrus-leaf sandals commonly worn at that time.

The principle of the turn shoe was applied to light work about the fourteenth century, —that is the shoes were commonly made outside in, and turned; but the seam was of the character of a flat seam. About the fifteenth century a form of rand was used for the lightest classes of work; this principle was in common use until the eighteenth century, but from this period the modern welt was in general favour until rivetted and pegged methods and the crochet stitch sole sewer were invented. With the introduction of welting machinery a revival of the welt seam took place which may have far-reaching consequences.

Naturally the character of the different parts have varied with the purpose that the finished shoe was intended for, and hence there have been soles of raw hide, of quilted satin, and of solid wood. And the tops have been cut from, or protected by, plates of steel: from plaited rope; from the finest of silk and satin brocade, embroidered with gold, crewel-worked with coloured silk, and studded with jewels. The shape also has varied without much reference to the real requirements of the foot. The Roman dandy with his gilded soles no doubt developed a bunion joint; his lady wore sandals with toes like a cow's horn. Our nobles of the middle ages tied the toes of their boots to their knees. A little later the shoes were fashioned as wide as they were long. The ladies of the seventeenth century tottered along on four-inch heels; the grand dames of Venice were led about upon clogs half-a-yard high. The Cavaliers had tops to their boots that made walking ridiculous; and the Roundheads wore jacks heavy enough for a modern diver.

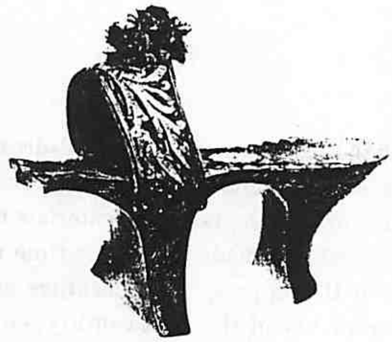
Among all nations, at all times, the foot appears to have been a suffering victim on the altar of vanity; we should therefore feel no surprise at the vagaries of modern fashion. Indeed, it may be safely asserted, that no historical period gives evidence of being more suitably provided with foot gear than the present time.

The shoe of the period of Henry VIII. is interesting from the extreme width and the method of seaming. The method of construction appears to have been upon the turn principle, but the awl, instead of being passed through the flesh of the sole and then through the face of the outside of the upper and so on through the lining, has been passed right through the thickness of the sole and through the edge of the upper. It appears that the upper was laid face down on the face of the sole, without any last or other supporting body, and the seam made quite through both substances; the shoe was then turned and the seam rubbed out; it appears to be neither strong or beautiful. The

Facing page 6.

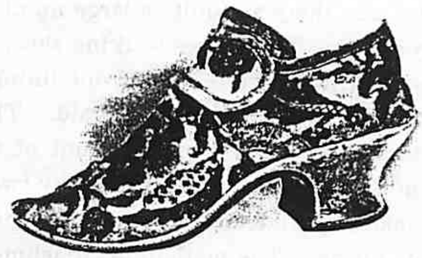
PLATE I.

Chinese Ladies' Shoe.

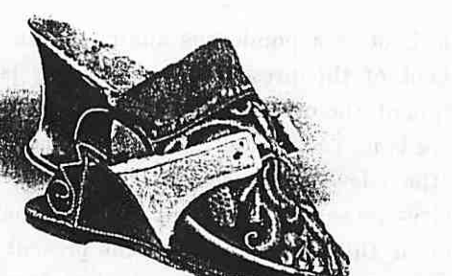


Turkish Bath Clog.

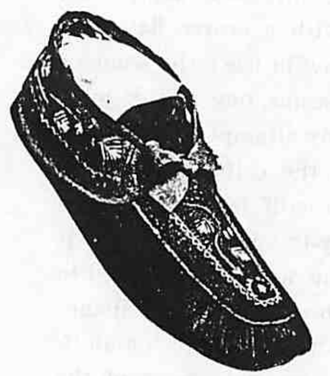
Cromwellian Jack Boot.



Queen Anne Shoe.



Patten Shoe XVII. Century.



Moccasin.

Skin Shoe (Rivilin).

Henry VIII.

EXAMPLES OF ANCIENT FOOTWEAR

IN NORTHAMPTON MUSEUM.

PHOTOGRAPHED AND REPRODUCED BY HOARE & COLE, NORTHAMPTON.

whole of the parts are cut from well-dressed cow hide and seem little the worse for the length of time that has elapsed since they were tanned. It would be interesting to know whether there are any known records of the tanning materials used at this period. From other specimens it is evident that a lighter shoe was made about this time upon the rand principle, and that much fine hand work was done upon the uppers, with slashings and insertions of coloured materials. But the work does not equal the quality of the next century, either in shape or fineness of execution ; but the quality of the tanned leather could scarcely be improved.

The Cordwainer of the seventeenth century reached a standard of skill and design of a very high order, and there are quite a large number of specimens of the work of this period that are a credit to the producers. The ladies' walking shoe, with patten, is a beautiful specimen of work. The sock is of figured silk, with white lamb front lining ; the outside of green velvet, with gold brocaded front bound with a broad band of gold braid. The sole is of fair substance, very narrow at the toe, very wide at the waist, stitched up the front of the heel and round the top piece. The top piece is of white lamb, and measures two inches by two inches and a quarter. The centre of the sole is blocked out to make a round cross section and the forepart having a good spring it produces a shoe with very large fitting. The method of attachment is by a white lamb rand sewn into the upper, turned back, and probably braced down. The sole is stitched to this with white stitching, sixteen stitches to the inch. The outer patten consists of an insole brought up in the waist to fit the shoe and stitched to the sole. A side piece is sewn in to cover the space left by the rise of the insole, and a side wing with fancy stitching attached to prevent the heel slipping sideways. The cover of the stitched heel and the side heel wing are red, and red beadings are inserted in the patten. Altogether it is a credit to the maker of the period.

The Cromwellian Jack Boot is a ponderous affair. The uppers are cut from stout hide, stouter than a stiff leg army boot of the present day. The leg is seamed with a coarse flat seam upon the outside. The principle of the cut of the leg is the reverse to that now in use ; the seam of the leg is down the front ; there is no back seam. The front has two cross seams, one at the joint like a vamp, the other from the edge of the seat to the throat, without any attempt to form an artistic curve. The leg is twenty-one inches high, and fourteen inches round the calf ; the general shape of the leg and inclination of the front is much as the present fashion for stiff leg boots. The top of the leg is seamed to a large loose extra piece, ten inches deep and thirty-two inches round ; it is folded down, but could have been drawn up over the thigh when new. The upper is attached to the bottom by a welt, the edge of the sole is half an inch thick, the heel three and a half inches high. The seat of the heel is sewn through without a channel, leaving the stitches bare, or aloft. The top piece is pegged with large triangular pegs. The boot has all the essential seams of the present day army jack ; the materials are of very similar nature ; naturally some of the seams have given way. The high heel, the corresponding drop in the waist, and curve at the joint, gives it a peculiar appearance. The proportions are small for a heavy boot like this, it is a size six, straights, not large in fitting ; very few army men of this day could wear it. It is somewhat remarkable that most of the existing specimens of this period are of small size.

The flowered satin Queen Anne shoe is a beautiful specimen of work, very similar in its construction to the patten shoe described, but with some very fine binding. The needle felled edge was cleverly executed at this period, and the heel covering would not be easily beaten to-day. In fact, shoemaking as an art craft, was in a very high state at this time. All the seams now known to

the hand worker were in use then. We have made great progress in the trade as a manufacture; we have new machine methods, and new machine seams; but as a craft, very little invention has been shown for three hundred years.

The product of the shoeworker of Asiatic countries is either primitively useful, or grotesque. The common wear of the poorer class is much as his ancestors have worn from time beyond history. The Fellaheen wears the footgear of his forebears. The Turkish lady goes to her bridal bath in a clog that might have been fashioned in Venice in the middle ages. In China the straw plait equals the demands of the poor; the lady is trained to totter on shoes not large enough for a fair sized doll. Even Japan still uses the foot covering of a thousand-year-old fashion—except for her fighters; these wear what are for all essential purposes an English modern military boot.

The greatest progress in shoemaking has been achieved during the last fifty years. During this period the upper stitching machine has come into general use; the sole sewer and the stitcher have been introduced, and have brought with them a vast number of inventions that have revolutionised the manufacture. It may be asserted that the American Civil War gave an opportunity to the boot stitching machine that precipitated its introduction by many years. We owe very much of our present condition to Blake, the inventor of the first sole stitching machine. The lock stitch of Howe, and the crochet stitch of Blake, are the two essential inventions that have helped to place good clothing at the command of the bulk of the working peoples. These have been the starting point for other inventors, and both of these men deserve the gratitude of the manufacturing nations.

Modern designs appear to trend towards severe simplicity and the perfect fitting of the foot; where elaborate footwear is required, the buckle shoe, the silk tie, and the long court of the early eighteenth century, are still in use. Probably the most original design of the last century was the elastic side boot, and this was owing to the invention of the fabric. But several developments of designs have been made from styles long in use, and provisions made for the requirements of modern manufacture, that have raised the art of the shoe designer to a higher eminence than ever before attained. The demand for perfect fitting footwear, for an elegant appearance, the exactitude of the processes of machine methods, and the rigid economy required, form a complication of problems that make boot and shoe design more than ever difficult.

The folded top of the Cromwellian boot has developed into the "jockey" top of the Hunting boot (Plate 2). With this we have a "jockey tongue," differing from the "butcher" by being shaped in triangular parts at the insertion. The flat seam is now made inside, and the seam of the leg down the back. We do not seam the front; the whole production is lighter. In fact, we have idealised; and our high-class "jockey," or hunting boot, is a fine specimen of the art and science of the bootmaker.

The essential principle of the "Oxford" shoe is very ancient; and it is not quite certain that we have improved the cut or the fit of this style during the last generation. At its best, it is an excellent form of footwear, but has been lowered in popularity through the use of unsuitable lasts in the making. In fact, we cannot alter human nature, and the public demand footwear of a greater curvature than the normal foot; in a boot this has a tendency to cause the footwear to lose its original shape, as it becomes blocked to the shape of the foot. In a shoe this defect is intensified and hastened; hence an admirable style of footwear has decreased in popularity.

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MODERN FOOTWEAR.

DRAWN AND REPRODUCED BY HOARE & COLE NORTHAMPTON

The Blucher front goloshed boot ("open tab") includes the essential principles of very old designs. A strip continuing a vamp round the back of a shoe was in use at the time of Louis XIV.; this is the essential principle of the golosh. In some cases it is joined at the sides, and has various degrees of curvature; but these strips appear to have been used for a long period. The seaming of the back over the vamp with loose pieces for opening up the lacing edge was used during the seventeenth century. Later it was called a Blucher. With the attachment of a golosh to the Blucher front we have developed the "open tab." The back strip has been adapted from the long boot, where it either joined a long strip passing up the leg, or formed a finish for the counter, or golosh, which covered the stiffening round the seat of the heel.

The button boot appears to be of comparatively recent design. The use of a flap for the attachment of the fastening is common in ancient boots; but the method of drawing the part round the outer side of the foot must have originated about the time that distinct boots for each foot became common. These flaps (button pieces) have been made of many shapes, with semicircular scollops, curved inward and curved outward, cut to points, and cut in one curve, as represented here. The button piece has, in recent years, been designed, without much success, to fasten on both sides; thus reverting to the straights principle. The curved vamp brought over the back appears to have developed from the slipper front; as, indeed, does the curved back piece. In fact, most of our designs appear to be combinations of a leg piece with what was originally a low shoe.

The bar shoe, with instep strap, is represented in specimens of great antiquity; but the application of a vamp to this design appears to be quite recent. Most of the specimens in existence have a front, or a front piece, that extends from the toe to the instep, meeting the cross bar from the side or heel. I cannot find any specimen that has an opening cut away below the instep strap; we may assume that this is relatively an original design.

Modern methods of construction consist more of applications of machine methods to execute processes hitherto done by hand than the originating of new systems. We have one new stitch—the lock stitch—essentially a machine stitch; and we have a machine method of forming the hand crochet stitch. Quite lately we have machine screwing, rivetting and pegging; a development of these by means of bent wire produces the stapling machine. At present, there is no machine method for making the cordwainers' hand seam, or, indeed, any probability of a solution of this problem.

But we have made immense strides in the production of footwear for the common people. The machine methods of working the edges and of attaching the parts, and of finishing the constructed boot, have been improved to a degree that has resulted in the manufacture of footwear of a beauty and general utility never before equalled.

A consideration of the methods of attachment will be found in the Chapter dealing with Seams, but it is not out of place to mention that the Oxford shoe represents a Blake sewn middle or clump, with stitched forepart and sewn waist. The riding boot, hand sewn welts, square to waist. The open tab lace boot, screwed middle through to heel, and stitched to heel. The button boot is Blake sewn. The bar shoe is a sewround (turn), stitched up the front of the heel.

CHAPTER II.

The Shape and Construction of the Foot.

IT is usual to select a perfect example of an object to be described. I have to admit to complete failure in my search for the ideal foot among those who have been accustomed to wear foot clothing. It is quite evident that the majority of people are more or less distorted in the feet; but the commonly ascribed reason, badly shaped shoes, is probably only a minor cause to this effect. The most usual defect is that the ends of the toes are permanently turned toward the centre line of the foot, producing an undue prominence at the joints and narrowness at the toe ends. There is abundant evidence that the widest part of the foot is naturally across the extreme ends of the toes, and not at the root, as provided for in all classes of foot wear.

There is no doubt but that the shoes of growing children should be so shaped; but it is not probable that this form will become popular, because we are generally more influenced by our vanity than by common-sense; while our women wear corsets we cannot expect them to wear footcovering of the natural shape of the foot.

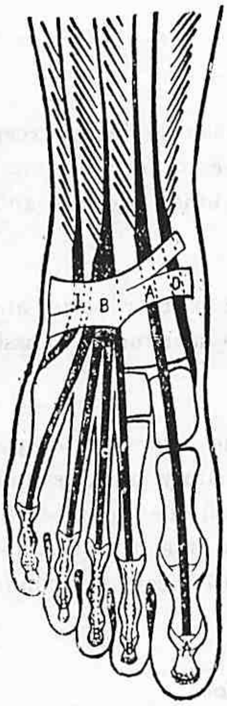
In a large number of examples, many of them photographs taken by the X ray method, I have found that the smaller toes are more or less pushed from their axis. This appears to happen at a very early age, when the bones are soft and the least pressure is sufficient to distort them. The pressure upon the foot of a growing child does not so much affect the great toe,—its greater strength and vigorous action counteracts it; but the smaller toes, with their less muscular action and more plastic nature, become turned towards the middle line of the foot, and consequently, practically all civilised people are more or less distorted in the small toes.

The pressure which causes this mischief is commonly the result of wearing tight, narrow-toed hose; in fact, any side pressure whatever is sufficient to cause this defect in the infant foot. It is so common, that most of the works upon the anatomy of the foot accept it as a natural condition, and pass it without comment. I have an illustration of the anatomy of the foot, issued for the guidance of students, in which the great toe has an incipient bunion joint, and the two outer toes are turned inward from their axis.

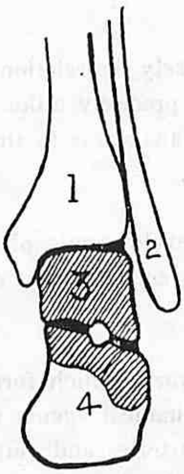
This being the general condition, and our object being to provide footwear for the majority, it would not serve our purpose to provide for an ideal that does not exist. We shall therefore deal with the foot as generally found, and the types as they are. It is not profitable to produce goods that excite more curiosity than customers.

Dr. Ellis, to whom we are greatly indebted, says "The two feet are perfectly symmetrical; a description of the right foot would serve equally well for the left, by the mere change of words having reference to the inner and outer sides. Each fulfils a precisely corresponding purpose in respect of the two sides of the body, and each is necessary to the other in completing the support afforded by the two together."

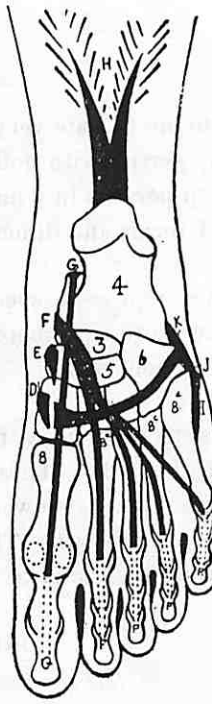
Plate 3.



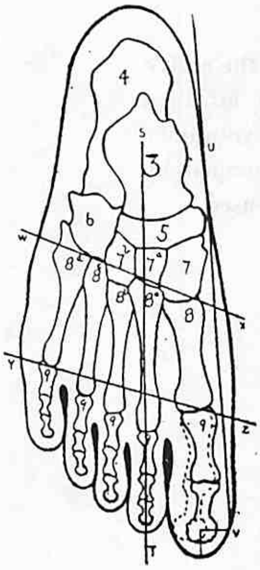
Muscles and Tendons—Top View.



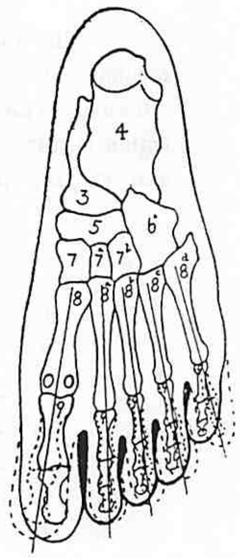
Section of Ankle Joint.



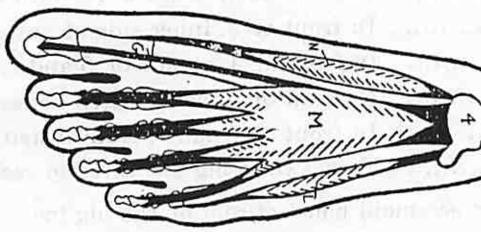
Muscles and Tendons—Bottom View.



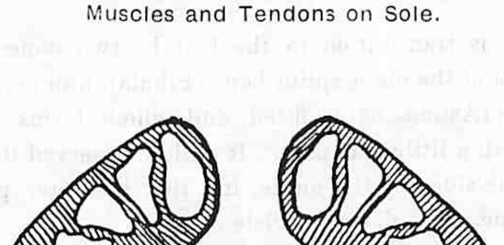
Bones of the Foot. Top View.



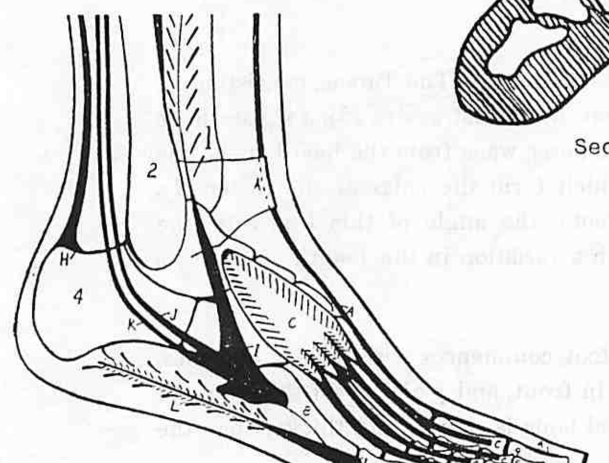
Bones of the Foot. Bottom View.



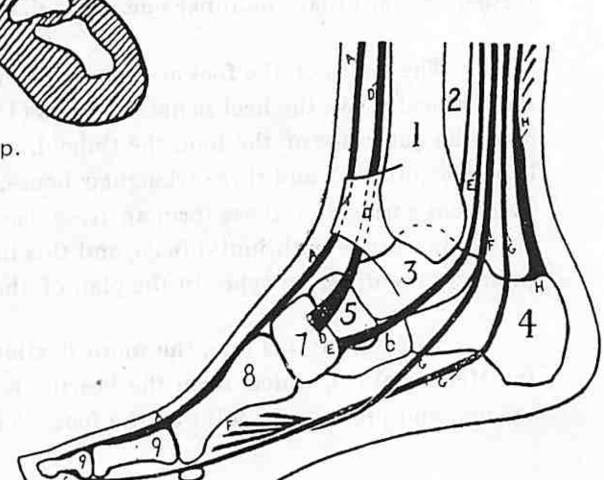
Muscles and Tendons on Sole.



Section across Instep.



Muscles and Tendons—Outer Side.



Muscles and Tendons—Inner Side.

This appears to me to state very precisely the relation between the feet: except that it is very uncommon to find any person with both feet precisely alike, either in form or measurement. The foot also varies between persons in a manner analagous to that of other features, and hence we have an immense variety of forms and dimensions.

These varieties represent special developments of some part or parts, and do not affect the principle of the structure, and therefore a consideration of the structure will assist in explaining the various types and dimensions.

The foot consists of a bony framework, which forms the levers and supports of the active mechanical agents of the will. These mechanical agents are mainly muscles and their attached tendons. The worn tissues are renewed by arteries and veins, and the impulse of each voluntary action is transmitted by the nerves. The whole of these are packed in soft tissues, and enveloped by skin varying in its nature according to the purpose to which the part it covers is commonly used.

Bones of the Foot and Leg.

No.	*Name.*	*Position.*
1. ...	Tibia	Inner ankle to knee.
2. ...	Fibula	Outer ankle to knee.
3. ...	Astragalus	Between 1 and 2, and above heel.
4. ...	Os Calcis	Back of heel, below 3, forward to outer waist.
5. ...	Scaphoid	In front of 3, inner side of instep.
6. ...	Cuboid	In front of 4, at side of 5 and 7.
7. ...	Cuniform (3)	In front of 5, main instep bones.
8. ...	Metatarsal (5)	In front of 6 and 7, from instep to joints.
9. ...	Phalanges (14)	Toes, two to big toe, three to each of others.

And two sesamoid bones at root of the big toe.

The weight of the body is transmitted to the foot by two bones—the shin bone (Tibia), numbered 1, Plates 3, 4, and 5; and the outer splint bone (Fibula), numbered 2. These form a joint into which the topmost foot bone (Astragalus) is fitted, and which forms a free hinge joint in the plane of the axis of the body, with a little side play. It will be observed that the lower part of these bones form the prominences at the sides of the ankle, and that the outer prominence is higher and further forward than the inner one. See diagram, Plate 3.

The bones of the foot are generally considered in three divisions:—The Tarsus, consisting of the Astragalus (3), the heel bone, Os Calcis (4), Scaphoid, in front of the Astragalus (5), a square bone upon the outer side of the foot, the Cuboid, which lies along the outer waist from the heel bone to the little toe joint (6), and three triangular bones, the Cuniform, which form the ridge of the instep (7). The front surfaces of these form an irregular line across the foot; the angle of this line with the centre line varies with individuals, and this in combination with a variation in the length of the toes produces the different types in the plan of the foot.

In front of this line, the more flexible portion of the foot commences with five long bones, the Metatarsal (8), which form the bearing surface of the foot in front, and which meet the bones of the toes and produce the joint of the foot. The inner Metatarsal bone is shorter and thicker than the

others, and with the strong bones of the big toe forms a powerful inner edge to the foot. The five toes are articulated to the front of the Metatarsal in irregular rows, Phalanges (9). These have distinct characteristics, although it is much obscured by the manner in which the foot is treated in infancy. The big toe has two bones which, when flat upon the ground, lay in the direction of the axis of the inner Metatarsal. The surface of articulation is at an angle with the axis in such a manner that as the toe is raised the end goes over towards the centre line of the foot. This deviation in the toe is shown upon the diagram of the upper surface of the foot (Plate 3). The smaller toes should point straight forward through their axis, but rarely do in civilized people. In a foot where the toes occupied this position, the plan would be as the dotted line in the diagram, showing the bones upon the bottom of the foot (Plate 3); that is, the widest part of the foot would be at the end of the toes. But the usual shape is shewn by the solid lines. In addition to these there are two small round bones, Sesamoides, shown at the base of the inner Metatarsal bone, which are attached to the tendon of the great toe, and prevent it being pinched.

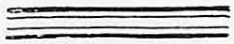
The surfaces of these bones that form joints are tipped with white elastic cartilage, which forms the smooth surface of articulation of the joint. Where there is much motion in the joint a provision is made for its lubrication, by means of a little bag which secretes an oily fluid, and which is squeezed by the action of the joint. The fracture of this bag is the primary cause of stiff joint, and commonly occurs during the formation of a bunion.

The structure of bone varies greatly with the age of the person; in infancy it consists mostly of cartilage, and can be bent without much discomfort to the child. Any persistence in the bending results in the bone taking the form, and, therefore, footgear for children should be quite free from anything likely to distort the foot. From this condition of comparative softness the bone gradually becomes harder, as the age of the person increases, until it is very brittle in old age. This gradual hardening commences from one or more centres in each bone (the centres of ossification), and therefore the ends of the bones being in a plastic condition for the longer period are the most likely to be put out of shape in childhood. There is also a considerable difference in the shape of the surface of articulation in the various stages of growth. In childhood the joints consist of more or less rounded bones; in advanced age these have formed surfaces that admit of little turning from the natural plane of the joint; and, therefore, the child's foot is exceedingly liable to be put out of shape during the first few years of growth. The difference between the shape of the surfaces of articulation will be seen by comparing the X ray photographs—Plate 4.

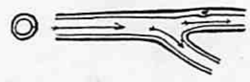
In fact, these photographs show the manner in which the foot is distorted during the production of the bunion joint, and the overlapping small toes. The extreme tip of the little toe is first turned inward by the side pressure of the hose or shoe; in extreme cases the other small toes are more or less affected, and the great toe is turned in the opposite way, also towards the centre line.

It is not probable that a bunion joint would be formed by mere side pressure, the toe is too strong; but the end joint of the great toe is commonly forced out of shape by this means. The bunion joint—that is an enlargement of the joint between the great toe and the inner metatarsal bone, is commonly caused by the wearing of short footwear. The toe being unable to lay straight is forced sideways by the end of the boot, straining the little oil bag in the joint (synovial sac) until some sudden pressure fractures it; the oil then exudes and the joint becomes stiff, the consequent inflammation and swelling producing what is called a "bunion joint." This is an extreme case, but fairly

Plate 4.



Nerve.



Arteries.

2—The Bunion Joint in the Making.

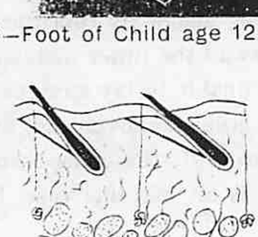
3—The Bunion Joint in the Making.

1—Adult Foot showing Articulation.

6—Foot of Child age 4.

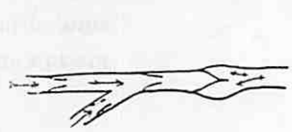
5—Foot of Child age 12.

4—Foot of Child age 8.



Skin.

7—X-Ray Photograph of above Foot.



Veins.

common; most feet show signs of this defect. The different stages of this are shown in "The bunion joint in the making."—Plate 4.

The bones are held together by strong elastic bands, called ligaments; these connect adjoining bones, and in some cases different parts of the bony framework. The lower part of the Astragalus, where it overhangs the Os Calcis on the inner side of the foot, is supported by a band of ligament. If from any cause—natural weakness or undue pressure—there should be a breakdown in this ligament, the result is flat foot. Another band passes from the heel to the root of the toes—the Planter ligament—bracing the two parts together. A very beautiful arrangement of ligament is seen in the bend of the foot above the instep, where a band holds down the tendons passing down the front of the foot. This ligament—the Annular ligament—is quite unique in its effect, and its development difficult to explain, except as an example of design.

It is a common peculiarity with all ligaments that intermittent action increases their strength and growth, and that constant pressure causes them to become weak and to decrease in bulk. This fact naturally teaches us that active exercise must be beneficial to most cases of weakness in the parts of the foot; and that long standing in one position is likely to result in the breakdown of the ligaments, and, as a natural result, the formation of flat foot.

The active movements in the parts of the body are caused by the contraction of the muscles and the corresponding extensions between the contractions. The muscles consist of three more or less distinct parts:—the origon, which is attached to the relatively fixed part; the body, or active contractible portion; and the insertion, that is, the strong band attached to the part to be moved. By this it is seen that a muscle (Plate 3) has a centre body and two ends—the tendons; the centre body, by lengthening and shortening at will, moves the ends and the parts that are attached to them. As the muscle contracts and shortens, it naturally increases in girth, and consequently, the clothing should not be tight over the parts that have active muscles. The tendons are simply cords that connect the muscles to the parts, they slip along grooves in the bones or tubes in the flesh without alteration of girth, therefore, providing there is no undue pressure, a closer fit is permissible where the foot is mainly tendons, than where the bulk of the foot is muscle.

When considering the action of the foot, we shall refer to a supposed centre line—terms as abductor (taking away), adductor (drawing towards), referring to, from, or towards, this centre line. The lifting of the foot forward and the toes upward is termed extending; and the drawing of the foot backward and the toes down the flexing of the foot. The muscles are therefore referred to as abductors, adductors, extensors, and flexors.

Muscles from the Leg to the Foot.

	Name.	*Position of Origon.*	*Position of Body.*	*Position of Insertion.*
A	Long Extensor of big toe	Leg bones	Calf	End of big toe.
B	Long Extensor of small toes	Leg	Calf	End of small toes.
C	Short Extensor	Tarsus	Tarsus—Instep ...	First bone of big toe and middle of next three.
D	Front Tibial	Tibia	Calf	Inner cuniform.
E	Back Tibial	Shin..............	Calf	Under part of cuniform.
F	Long Flexor of small toes	Leg	Calf	End row of small toes.

	Name.	*Position of Origon.*	*Position of Body.*	*Position of Insertion.*
G	Long Flexor of big toe ...	Leg	Calf	End of big toe.
H	Large Flexor of heel	Leg	Calf	Back of os calcis.
I	Peronial.........................	Outer leg.........	Outer calf	Root of little toe.
J	Short Peronial	Lower leg	Lower calf	Outer matatarsal.
K	Long Peronial	Outer leg.........	Lower calf	Crosses under foot to inner edge.

MUSCLES ON FOOT.

L	Abductor of small toe......	Outer side of heel	Outer waist.........	Root of little toe.
M	Short Flexor of small toes	Os calcis	Waist of foot	Second row of small toes.
N	Abductor of big toe.........	Outer side of heel	Outer side of waist	Root of big toe.

These are shown upon the diagrams—Plate 3. In addition to those mentioned there are a number of smaller muscles that act as auxiliary muscles in the finer movements of the foot, and which are most developed in people that have not clothed their feet in infancy, or who commonly use their feet in some processes of labour. The Hindoo shoemaker uses his feet as auxiliary hands, but he rarely wears the boots that he makes.

This summary shews that the muscular parts of the foot are at the lower instep, the waist and ball of the foot, and at the sides. The muscle on the instep is often finely developed, and forms quite a pad just above the root of the toes. This should be provided for in all full fitting lasts; the rise of the curve towards the instep should commence directly after the joint point, and not, as often seen, at some distance behind the actual root of the great toe. In the muscular foot the abductor of the great toe along the inside waist is always prominent, and often forms an outward curve; full fitting lasts should be left full here, a great deal of the instep measure is made up at this part, and should be in the last. The muscle upon the outer side of the waist is rarely adequately provided for in footwear; it is in the foot nearly in a line from the root of the little toe to the heel, and never has the curve commonly found in lasts.

The muscles situated on the sole are closely connected with the long tendons coming from the leg. The flexor tendons are split to allow long tendons to pass. It should be noticed that the tendons upon the top and bottom of the foot are very similar in their arrangement. There is in each case a strong tendon from the leg which divides and is attached to the toes. Upon the upper part of the foot the extensor tendon is seen passing under the annular ligament and dividing into four; a similar thing occurs upon the lower part of the foot, the long flexors dividing in the centre of the waist. The short flexors, with an adductor of the great toe, are situated in the waist beneath the arch, which forms a protection. It appears rather absurd to unduly arch the waist of our footwear, seeing what careful provision nature has made to prevent any restriction at this part.

The curvature of the sole of the foot depends very much upon the condition of the calf muscles. If they are well developed, and the long flexor muscles normally taut—that is if the person has a springy gait, or skips, or commonly uses the front of the foot more than the heel in walking—then there is a good waist curve; the arch is springy. The cause of this is very simple, and easily understood from the diagram of the inner side of the foot—Plate 3. The long flexor muscles passing round the back of the ankle and to the toes, naturally brace up the arch of the waist, the ankle, and the whole of the inner side of the foot. The tibial muscles, by their tendons, assist in this, and therefore, any exercise that uses these muscles must assist in bracing up the arch.

The arteries which carry the nourishment to, and the veins which carry the waste from, all parts of the system, consist of long plain tubes terminating in infinitely small apertures (capillaries), through which the blood is pumped from the heart into the structure of the system, carrying the nourishing principle with it. It is then collected with the waste products by similar capillaries at the commencement of the veins, and conveyed back to the lungs to be purified. The arteries are plain tubes, through which the blood pulses as the heart beats. The veins are tubes with an arrangement of valves that do not allow the blood to travel towards the capillaries. Consequently, the effect of pressure upon these is very different ; pressure upon a vein retards the progress of the warm pure blood to the foot, and therefore starves it and causes it to become cold. Pressure on a vein prevents the blood returning to the heart, causes an accumulation of blood in the foot, and a consequent swelling. See Plate 4.

The space between these parts of the foot and the skin—the packing of the foot—consists of fibrous tissue and fat. The amount varies between individuals and greatly affects the character and girth. It also varies in different periods of life. In youth the fat is distinct from the muscle, rather easily exhausted, and not very sensitive to pressure. In advanced age and poor condition, the muscles contain deposits of fat between the fibres : this causes great sensitiveness to pressure, and general tenderness. Therefore the plumpness of a foot is little indication of its power to bear tight fitting ; the age of the person and their condition are important factors.

The skin of the foot consists of two distinct kinds. The skin covering the sole is thick fibrous and closely attached to the surface of the foot by a planter fascia, which does not permit of much movement. The palm of the hand has a very similar skin, but much thinner. The upper part of the foot, like the back of the hand, is covered by ordinary loose skin, which has considerable elasticity in any direction. It must be evident that a loose skin on the palm of the hand, or the sole of the foot, would give a very uncertain holding surface.

Like all other tissues, the skin increases with friction and wastes under constant pressure. Therefore friction from any part of the clothing produces a thickening, and as the centre of the surface of friction must be subjected to the greater amount, this centre forms into a very hard substance which presses inward upon the skin. This pressure, being constant, causes a wasting away of the tissues until the true skin is pierced and the "corn" and its core become very painful.

The skin consists of two distinct parts, which are closely connected in the normal state, as commonly seen, but which easily separate, as seen when scalded or blistered. The true skin, closely connected with the fibrous tissues of the body, is formed by interlacing yellow fibres, crossing and branching in curves that leave oblong spaces that are filled in with white tissues. These contain arteries and veins ; and the nerves pass through in infinitely small and sensitive chords, forming little eminences on the outer side of the true skin, that are extremely delicate and exquisitely sensitive. These nerve ends (papillas), produce the delicate sense of touch, so sensitive that actual contact is painful, as most of us know by the delicacy of the skin beneath a blister. To protect this delicate surface there is an outer skin (the scarf) which has no sense of feeling, but which carries the sense of feeling of the true skin. The roots of the hairs are embedded in the true skin, in tubes that appear to be part of the scarf ; at the lower end of these tubes (hair sheaths) there are connections with the skin beneath. Sweat ducts (tubes) pass from the skin through the scarf skin, carrying away vapour and water from the parts beneath.

The general bearing of the foot is best understood by reference to the impression made by the two feet when standing, and the diagram of the transverse arch upon a flat surface. This is shewn upon Plate 5, by which we see that the inside waists considered together form nearly a semi dome, and that the outside waists are nearly flat with the ground. The line from the centre of the heel along the axis of the great toe (the Meyer line) represents the line of traction of the main muscle (line of greatest force). The line across the end of the toes marks the points that should be considered in the designing of sole shapes; this would be nearly constant on the inner side, but would vary with the type of foot on the outer side, as is shewn by the types of feet. The actual primary bearing points are generally considered to be the centre of the heel, the roots of big and little toes and the swell of the great toe. In the attitude of standing this is no doubt correct, but in active exercise the contact is not simultaneous. For instance: in running, the joints of the foot come down first and the whole foot flexed back with a sudden thrust that projects the body forward, clear of the ground. In walking, the heel is usually brought down first and drawn back until, first the outer waist, then the joints, and lastly the big toe come in contact with the ground. This dragging action distinguishes the walk from the run or jump.

The different types may be classified by the relation between the centre line and the line passing between or across the joints. This is the line mentioned as being at various angles with the centre line at the end of the tarsus.

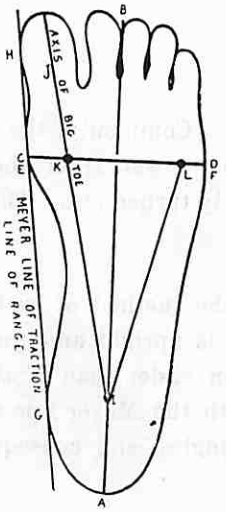
Plate 5 shews three types of feet, the method of defining these would include all classes. The centre line AB divides the foot in its length. A line CD taken from the inside joint at right angles to AB should pass in front of the outside joint line EF by one tenth of the length of the foot; this is the normal foot. Square forms are when the lines CD, EF, pass across both big and little joints, as Fig. 2; pointed toe, when the distance between the lines is at a greater angle than the normal, as Fig. 3. When using this method we should refer to the types as—1/20, 1/16, 1/14, 1/12, 1/10, 1/8 etc.; thus defining the position of the relative parts. The relative type may also be classified by the prominence of the inner joint. This is usually accomplished by dividing the difference between the width of the tread and the heel, and determining the type by the amount that the inside joint stands beyond a line drawn from the side of the heel, to the side of the great toe. The line GH, Fig. 1, 2, 3, Plate 5, shews the manner of defining this. The slope of the toes would be called the angle of the tread, and the proportions be made in reference to the length of the foot or last. The relative prominence of the inside joint is called the range, and the degree is in reference to the proportion of the difference in the width of the tread and seat.

The line GH is also commonly called the Meyer line—from the German Professor who first defined it. This line coincides with the main flexor muscles, which are, collectively, with the large flexor of the heel, the strongest group of muscles in the foot. The points I, L, K, represent the main or tripod bearings, and it will be noticed that when the Meyer line touches the heel and the great toe, that is when the inner side of the foot is straight, the axis of the great toe carried backwards passes through the centre of the heel. When the foot is of this type the great toe commonly stands away from the next toe, as it should; therefore the most correct form of foot is when the inner line is straight.

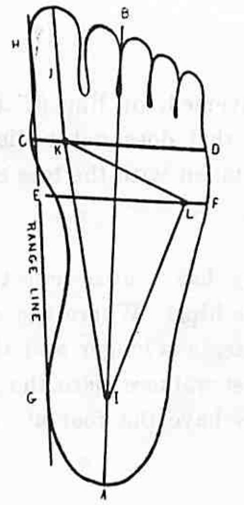
Seeing that the line of greatest power is along the Meyer line, it appears evident that the most efficient position of the foot in relation to the direction of the body must be when the Meyer line is

To face Page 17.

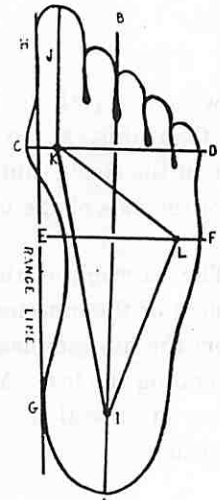
Plate 5.



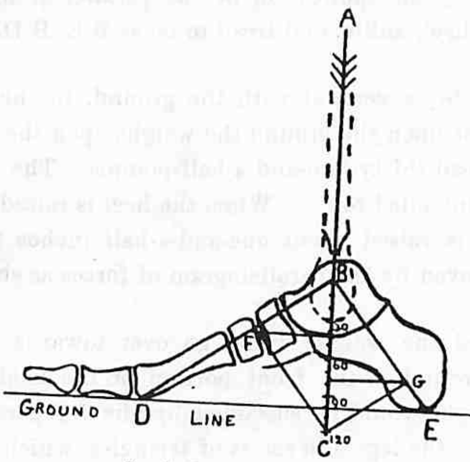
1.



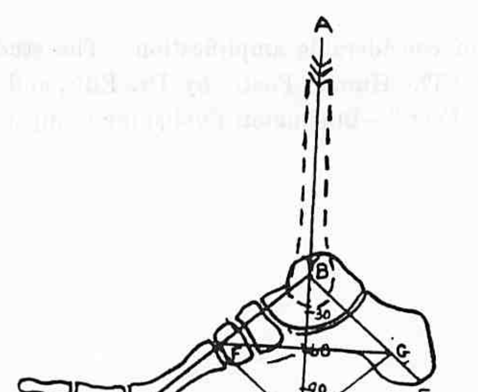
2.



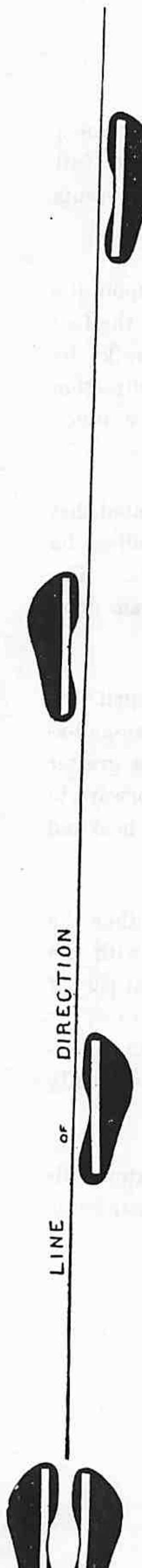
3.



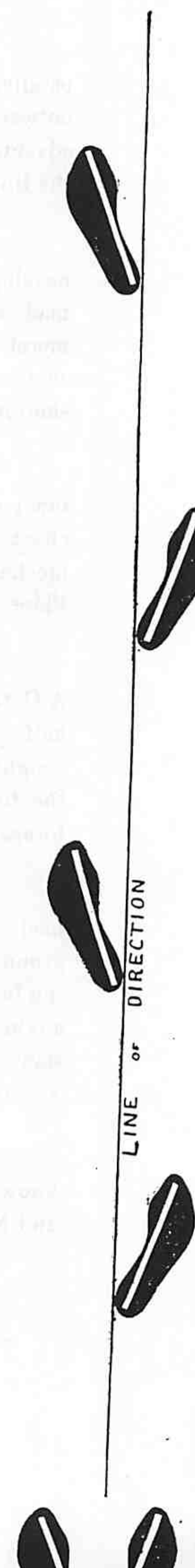
Foot Flat on Ground.—4.



Heel Raised one-and-a-half Inch.—5.



6.



7.

parallel with the path to be traversed, or line of direction. Commonly, the foot is more turned outward than this, at an angle that does not utilise all the power from the long flexors, full advantage of the stride cannot be taken with the toes excessively turned out. The line I J represents the line of the axis of the big toe.

The carriage of the body has a great effect upon the method of walking, and upon the development of the muscles of the hips. Where the carriage is upright and the draw upon the foot made from the hip muscles, the stride is longer and the action easier than if the person walks by merely bending the leg. Most fast walkers place the foot with the Meyer line in the same direction as the line of direction. Others have the foot at various angles, and consequently take a much shorter stride.

It is very truthfully asserted that no two people walk quite alike; it may also be stated that few people have quite the same attitudes of standing. And still fewer appear to quite realise the effect of an elevation of the heel as commonly brought about by the use of high heels. The mechanical effect is shewn by an application of the parallelogram of forces, in the diagram upon Plate 5, and the angle of the heel, ankle, and tread to be as B E, B D.

Assuming the weight to be vertical with the ground, in the direction A B, and to equal 120, A C, then when the foot is flat upon the ground the weight upon the heel would be sixty-seven-and-a-half pounds, and upon the tread thirty-two-and-a-half-pounds. The heel would sustain the greater weight, as it is undoubtedly intended to do. When the heel is raised the weight is carried forward to the forepart, until when it is raised about one-and-a-half inches the weight upon both heel and forepart is equal. This is proved by the parallelogram of forces as shewn—Plate 5.

As the heel is raised the weight would go over towards the toes, until when either the heel was elevated from the ground or the front portion of the angle was at right angles with the ground, the whole of the weight would be sustained by the forepart of the foot. The front part of the foot represents the ends of the legs of a series of triangles, which have their common apex at the ankle joint, and which naturally extend as weight is thrown upon them. By this it is easy to understand why a wider fitting is required for high heel boots than for low ones, and why those usually wearing high heels develop large joints.

This subject admits of considerable amplification. The student who wishes to extend his knowledge is advised to read "The Human Foot," by Dr. Ellis, and "The Anatomical Construction and Natural Functions of the Foot"—Burlington Publishing Company.

CHAPTER III.

Measuring the Foot and Fitting up Lasts for Bespoke.

BY "bespoke work" we mean the production of special pairs to the peculiar requirements of some one person. This usually includes the taking of a special measure and the alteration of the lasts in common use or the making of special lasts.

It must be evident that to fit any object like a foot, we require at least the correct shape, in addition to the actual measures. Seeing the great differences there are in the types of feet, the mere measurements are not sufficient, although sometimes made to do.

The actual information required to prevent probability of error is :—

The length of the foot when at its greatest extension—that is taken when the person is standing upon it.

The shape of the foot by a plan (draft) or cast, or an impression, either of these being marked with the position in which the girth measures were taken, and the location of tender places ; as corns, etc.

Girth measures over the parts marked upon the draft or impression, with preferably the distance of each measure up the front of the foot from the toe end. For the other measures—the heel, from the ball of the heel to the bend of the foot above the instep ; the ankle measure round the thin part of the leg above the ankle bone ; and the other leg measures not less than two inches apart up to the calf : above the calf the measure should be taken at each four inches ; each one of these leg measures should be located by its distance from the inner side of the edge of the heel. Any special peculiarity should be noted and instructions given for the allowance required for it.

It is preferable that a special order sheet should be used : this is usually called an order form ; a specimen is shewn upon Plate 6. This provides for a separate draft of each foot. A plain sheet of paper may be used if a form is not available. The foot should rest upon the ground, but the person should not stand while the draft is being taken. The location of the measures should be marked upon the side of the draft. The position of corns or tender places should be indicated by a cross ; corns that are upon the under part of the foot, or which are some distance from the edge of the upper surface, may be located by first drawing a line in their direction pointing from the side of the foot, and then another at the toe end also pointing towards the corn. When the foot is removed and these two lines are continued they will meet in the position of the corn.

When taking the measure, the front part of the foot should be lifted, allowing it to rest lightly on the heel. The angle of the location tape should then be placed upon the first point of measurement, with the distance regulator hanging over the toe and the girth tape passing straight round the foot. The measurement taken may be recorded either upon the side of the draft where the location

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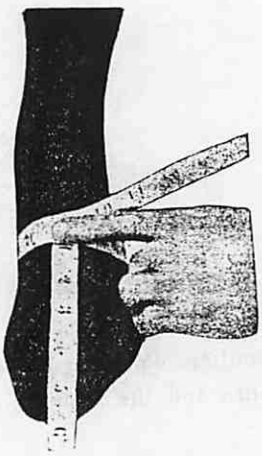
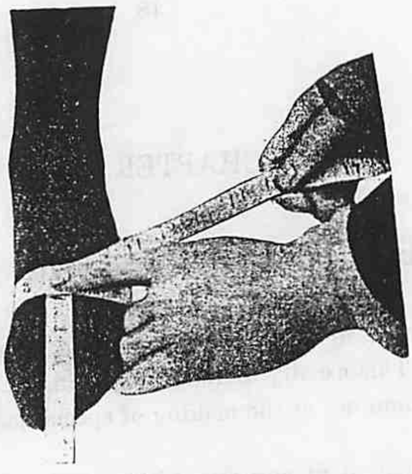
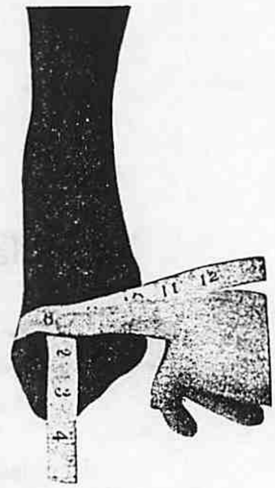
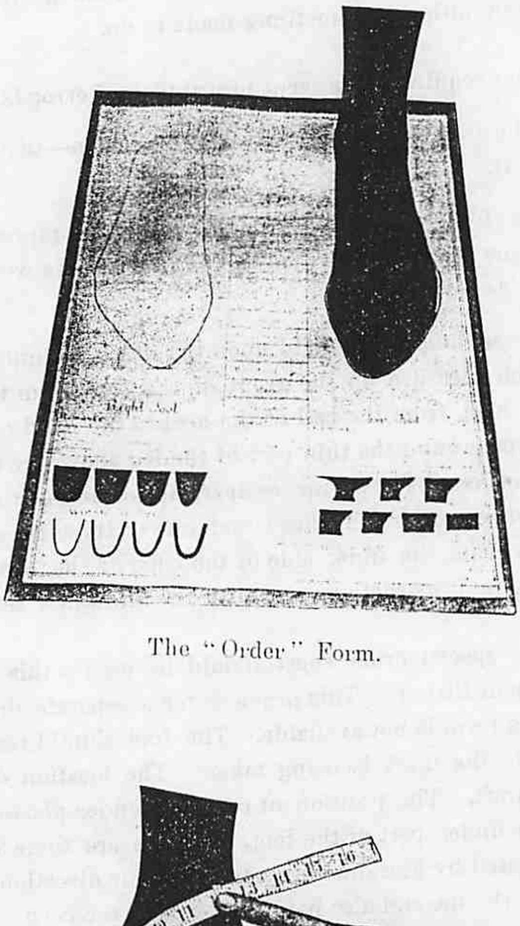
Plate 6.


Instep.


Lower Instep.

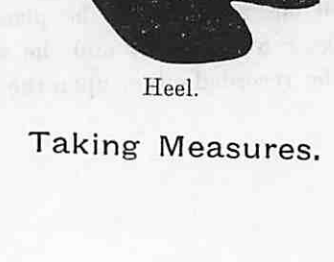

Joint.

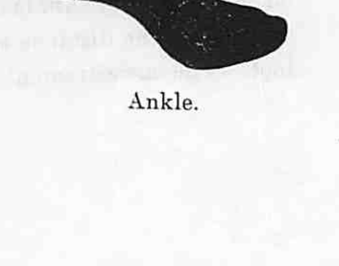

Taking Length.


The "Order" Form.


Marking Draft.


Leg.


Heel.

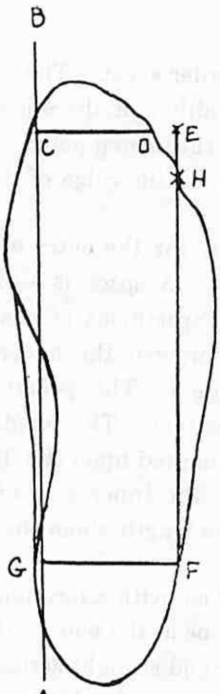

Ankle.

Taking Measures.

To face Page 19.

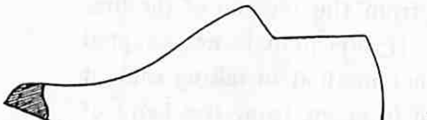
Plate 7.

Normal Form.



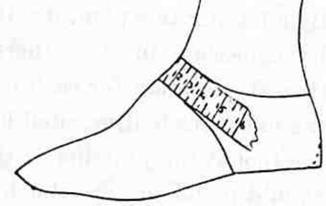
Determination of Type.

Weak Ankle.

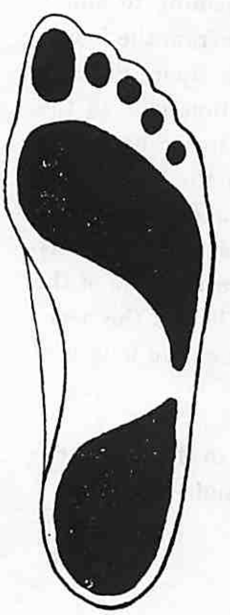


Toe Pin.

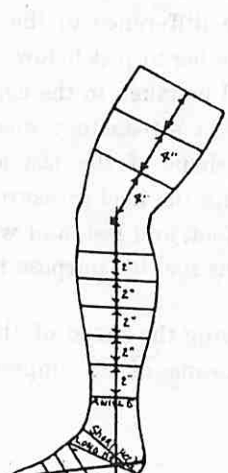
Location Tape.



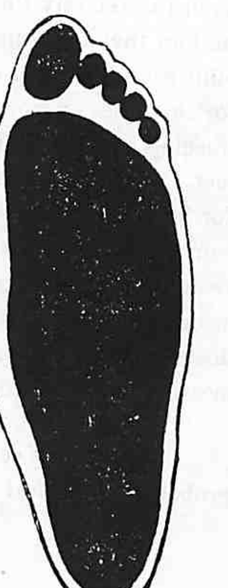
Heel Measurer.



Average Foot.



Measurements.



Broken Down Waist.

of the measure is marked or in its place in the order sheet. The other measures up the front of the foot may be taken in the same manner, but although there is considerable latitude in the number taken, a measure should certainly be taken over the instep point. This instep point may be found by passing the hand up the foot, when a small bone on the ridge of the instep can be easily felt.

Spaces between the two drafts are left for the entry of the actual girth measures and their distance from the toe end or the side of the heel. A space is also left at the bottom for the entry of the special requirements of each separate foot. Specimens of shapes of toe, width of welt and shape and length of heel are printed on this form, to prevent the uncertainty of verbal descriptions. The method of marking the draft is shewn upon Plate 6. The pencil should be kept in such a position that the mark made is level with the edge of the foot. The length should be taken when the person is standing, or the length of the foot carefully marked upon the draft line. While the foot is flat on the ground place the size stick sideways against the inner side of the foot so that the upright presses against the back of the heel. This will give the length when the foot is fully extended.

The girth measures are preferably taken with a location tape (see Plate 7). Joint measures should be taken with one end of the location tape at the end of the great toe with the commencement of the tape on the great toe joint and the other end straight across the foot. If the little toe joint is not opposite the great toe, a second joint measure should be taken. This may represent a lower instep measure.

It is a good plan to first take a joint measure over the big toe joint; note the distance from the end of the great toe and then take the other measures up the front of the foot at one inch apart. By adopting this plan, it will only be necessary to notify the distance from the toe end of the first joint measure and the others will be understood to be at one inch apart. If this plan is not adopted then the location for each one must be marked upon the draft. The actual method of taking each of the measures is illustrated by the diagrams—Plate 6. The heel measure is taken from the bend of the foot at the junction of the leg with the top part of the instep and round the ball of the heel. It should be taken with the heel raised, as near as possible, the height of the heel the boot is to carry. The ankle measure is taken by dropping one end of the location tape down to the inner side of the heel; the other end of the tape being carried straight round the leg. Other leg measurements are taken in precisely the same way. For ordinary long boots that are not cut with an opening to admit the foot the ankle measure is not required, but it is an advantage to take a measure from the instep point round the ball of the heel. This is called the long heel measure and shewn upon Plate 7. For this class of work care should be taken to ascertain whether the wearer uses continuations to the breeches or not, as this makes considerable difference to the measurement required in the leg of the boot. The distance should be taken up the leg to just below the bone of the knee on the inner side. For boots above the knee a measure should be taken to the centre of the knee joint and then at each four inches up the thigh. One of the least satisfactory measures is the heel measure, principally owing to the great difference between the shape of the last and the shape of the heel; some of the inconvenience might be prevented by taking the heel measure at one inch above the ball of the heel; this would give a constant point on boot, foot, and last, and would admit of a very accurate long heel measure being taken. A piece of apparatus for this purpose is shewn on Plate 7.

There are several means of conveying the shape of the bearings of the foot to the last fitter; probably the most convenient is by means of an impression. By an impression we mean a

reproduction of the bearing surface of the foot produced by standing upon some kind of transfer paper. This paper can be made by soaking ordinary blotting paper in a solution of any dye in alcohol added to an equal quantity of glycerine. This paper should be put on one side for a few hours until the excess moisture has evaporated; it is then placed between two pieces of clean blotting paper. The person standing upon this produces two impressions: one of the foot, the other of its reverse. A draft may be made at the same time by simply drawing a pencil or style round the foot.

Casts are sometimes taken of the foot for special purposes, but except in surgical cases they are rarely of much practical use to the last-fitter. Probably the most useful method is to make a rather soft preparation of pipe-clay; place this in a shallow box about 14 inches long by about 7 inches wide and 2 inches deep. The pipe-clay should nearly fill this box. The upper surface should be then dusted over with French chalk and a little French chalk rubbed over the foot or the hose. A person placing the foot heavily upon the pipe-clay will produce an impression in relief, from which casts may be taken. Where a special cast of some part, as the side of the ankle in cripple work, or the curvature of the waist, the foot may be placed sideways upon the pipe-clay, and if necessary, the pipe-clay may be moulded up to the side of the foot and a cast then taken from the mould.

A very good moulding compound may be made from equal parts of Fuller's earth and vaseline. This may be used in the same way as pipe-clay or ordinary plaster of Paris; either can be knocked up and re-used for several casts. The casts from these are used for the purpose of comparing the lasts with the form of the foot, and for providing for special peculiarities. The character of different impressions or drafts are determined by the relation between certain lines drawn upon them. Plate 7 shews the method of determining these characters. The line A B drawn from the side of the great toe to the side of the heel C G, should be taken at half an inch C from the end of the great toe. The amount of great toe joint which is cut off by this line determines the character of the foot and of the last that is required for it. This line is the same line as was shewn upon Plate 5—the Meyer line—it determines the range of the foot.

The slope of the toes is shewn by the cross line C E from the big toe. This should be taken at right angles with the range line, and made the same length as the width of the seat. The relative position of the toes with this point determines the degree of slope, where the outline meets E represents the normal slope. The range line, slope line, and the line from the slope point to the outer side of the seat are used in the designing of sole shapes. (See Sole Shapes.)

The last should be about an eighth of an inch less than the draft of the foot, except across the the end of the toe, where it should be longer according to the requirements of the foot and the shape required in the toe of the boot.

The general range of the last should be straighter than the draft, in a degree proportionate to the height of the heel. It is found, as stated in the Chapter of the Anatomy of the Foot, that, as the big toe is raised, the end goes over towards the centre line of the foot. A boot with a half inch heel may be considered normal, but for every additional half inch added to the height of the heel the sole should be straighter by one degree.

There should also be a difference in the spring of the toe of the last, according to the character of the work. For light dress work the spring of the toe should be half an inch; for ordinary walking

purposes, three-quarters of an inch ; for stout walking boots, one inch ; for heavy navvy work, an inch-and-a-quarter. The spring of the toe is determined by first raising the heel of the last to the height that it would be, relatively, when in the boot. The height of the toe would then be measured from the surface upon which the last stood.

It is usual to make the waist of the last with much more curvature than the waist of the foot, and the result is that as the foot blocks the waist of the boot into its shape, the boot becomes out of the original form. This is very evident in the case of shoes, as the bad effect shews immediately by the quarters gaping. In boots this is not so apparent, because the leg of the boot disguises the defect ; but it is unquestionable that shoe lasts should be the same curvature as the foot in the waist. Long work is usually made upon lasts with a rather squarer seat. It would be an advantage if the back of the last above the counter was fitted up squarely to help to hold the boot out in the making.

Another matter which has great effect in the fit of the boot is the degree of curvature across the bottom of the seat and tread. The largest amount of room and the greatest comfort in wear is secured by a round cross section in the bottom of a last. The flat bottom, although apparently making a last easy to work upon, produces a boot that does not conform to the shape of the foot. It will be found that where a full fitting last is required, the round seat and round cross section of the bottom will be most satisfactory.

Plate 7 contains several illustrations of the different types of drafts and impressions. The normal draft is rarely met with among sedentary workers, although common enough among a rural population. It is practically a Meyer form, that is, the inner margin of the foot conforms to a straight line. It will be noticed that the inside ankle curve is nearly straight, and that there is a marked difference between the curves of the inner and outer waist. The impression of a flat foot is an instance of the effect of long standing in one position ; it was taken from the foot of a clicker, and is quite flat in the waist ; in fact the inside ankle curve and the inner waist are practically the same.

The comparison of the curve of the inner ankle and the waist curve is of great value in determining the character of the foot from a draft or impression. When the outline of the ankle curves outward on the draft it is a sure indication of a weak ankle. Upon the other hand, any inward curvature is an assurance of some spring in the waist. The value of these deductions is that in making allowances for the extension of the foot, a greater amount should be made for a springy foot than for a dead one. It is generally assumed that when the weight is thrown upon the waist bone as Plate 5, that the foot extends one-twentieth of its length, that is, about half an inch, or a size and a half.

The arched foot is the reverse of the dead foot, it is never found in connection with a low ankle curve. This illustration represents an upward curve in the waist of about an eighth of an inch clear of the ground in the centre. This is very much less than lasts are usually sprung in the waist, and is an example of the excess of spring usual. The bunion joint is a representation of the ignorance and folly of shoemakers and shoe wearers. There is not much doubt but that the cause is through wearing short footwear. The great toe is always deflected towards the next, often so much, that it either overrides or pushes under it. It is often accompanied by broken down waist, bad corns, and hammer toes.

Hammer toes are caused through the permanent shortening of the tendons ; the length of the flexor tendons from the fork where they divide, must be proportionate to the length of the toes ; if one or more are short, then the toes attached to them cannot extend, being held by the main tendon ; and the consequence is that they are permanently fixed, causing what is termed hammer toes ; this is a surgeon's business. The shoemakers can only provide for the room it requires in the boot.

When lasts are fitted up for very high heels, or for cripple cork work, care should be taken that the true length of the foot is provided for. It will be found that, owing to the joint of the great toe forming the centre of a circle, as the end of the great toe turns upwards it approaches the heel of the foot, and consequently very high heels should be made on lasts that would be shorter in length on the size-stick, than those intended for a low heel. This shortening takes place through the upward turn of the toe and not in the actual line length of the foot. Indeed, it is not quite certain that the foot does not slightly increase in length, while the length of contact slightly decreases.

The practical effect in last fitting is : that there is no difference in the length of the inner sole shape, but that the forepart for very high heel work has to be made shorter in the proportion of about one-twelfth-of-an-inch for each half-inch that the heel is raised above half-an-inch higher. This shortening ceases when the heel is raised about 2 inches.

There is a great difference between the available length of a last and the length as recorded by the size-stick. If the toe of the last has the full thickness up to the end, the accommodation in the last would be represented by its length upon a size-stick ; but where it has a receding toe the accommodation is determined by the highest point of the puff. The part beyond that which is bevelled off is of no value for the accommodation of the toe. Therefore, all measurements as to length should be taken from the highest point of the puff.

Girth measures upon the last should be taken very carefully over exactly the same path as the measures were taken over the foot. This can be done by comparing the last with the draft.

There is generally some difference made between the girth of the foot and the girth of the last : the difference varies with the part. The joint having most muscular formation should be fitted up to the joint measure. The instep may be fitted a quarter-of-an-inch less ; the heel measure should be fitted about three-quarters-of-an-inch over the measure of the foot ; other measures up the leg should equal the girth measures over the respective parts.—See Scale.

ALLOWANCES AND DEDUCTIONS BETWEEN THE MEASUREMENTS OF THE FOOT AND OF THE LAST.

Size.	*Joint.*	*Instep.*	*Heel.*	*Ankle.*	*Leg.*	*Length.**
0 to 6 Infants'.	1/4" Over.	1/8" Over.	1/2" Over.	1/4" Over.	1/4" Over.	½ Size Over.
7 to 10 Children's.	1/4" Over.	1/8" Over.	1/2" Over.	1/8" Over.	1/8" Over.	1 size Over.
11 to 1 Children's.	1/8" Over.	1/8" Over.	1/2" Over.	1/8" Over.	1/8" Over.	1 Size Over.
2 to 5 Youths'.	1/8" Over.	Equal.	3/4" Over.	1/8" Over.	1/8" Over.	1½ Sizes Over.

Size.	*Joint.*	*Instep.*	*Heel.*	*Ankle.*	*Leg.*	*Length.**
2 to 7 Ladies'	Equal.	1/4" Under.	1/2" Over.	Equal.	Equal.	1 Size Over.
6 to 11 Men's.	Equal.	1/4" Under.	3/4" Over.	Equal.	Equal.	1½ Sizes Over.

* These allowances for length are when the length of the foot is measured while the person stands upon it. If the length is taken when the foot is off the ground, a half-an-inch is to be added to all the above allowances for lengths. For girths, the foot is assumed to be measured when raised from the ground.

There are some differences required in the allowances between the measurement of the last and the measurement of the foot, according to the nature and substance of material and the character of the shoe.

Light, stretchy materials, which naturally give a great deal when pulled, if made by any method that does not keep them on the last for several days, naturally go back after the last is withdrawn. In the case of crups and other materials of that character, if the last is fitted up close to the measure, the boot is likely to be too small in the fitting. Where the boot is made by hand method, or kept upon the last for some time, there is not so much return to the original size, and therefore a a closer fit may be made.

Stiff materials if made by a machine method and taken off the last very quickly after lasting, very often come out too large in the fitting, and have therefore to be fitted up rather smaller. In some methods they are really not lasted at all, except just round the toe. If the same material is made up by the hand method, *i.e.*, hand lasted and left on the last, a much clearer boot and closer fit is the result.

From this it is seen that much must be left to the judgment of the last fitter; but as a rule, stretchy materials made machine sewn should be fitted full up to measure; thin stiff materials a little under measure.

The form of the last has considerable effect upon the size required, square edged lasts naturally have a great deal of waste space; the foot cannot fill the square edges and therefore there is at each side a small portion of waste measurement. This type of last has to be fitted up full to measure round the joint. Lasts with round edges naturally accommodate the foot better than a square last, but do not make up well for very heavy work. It naturally follows that a round edge last may be fitted up close to the measure.

The position of the fittings used on the last has considerable effect on the difference required. For instance, whenever an extra amount is required on the joint measurement, it is commonly placed upon the outside, although very frequently there is an excess of measurement about the feather of the inside joint. It would be far better to put the fitting required on the ball of the inside joint, allowing the foot to come over on the inside: this would ease the outside joint and fill up the waste space on the inside feather.

Care must be taken when fitting up the ball of the inside joint that provision is made for the swell of the inside waist, along the counter. If this is not done the foot touches at the corner of the

stiffener, and although there may be plenty of room in the boot, the foot is pushed over towards the outside joint, treading the boot over on the outer side, although there may be quite sufficient joint measurement.

The class of work has considerable effect also upon the difference between the foot measurement and that of the last. Light shoes for evening dress wear are always made of a close fitting ; the wearer does not do much more than stand about in them, and as they are required to look smart, there is no objection to a tight fit. Shoes for walking purposes must have a full fitting joint measure ; the instep measure should be close in the fitting ; this gives a firm feel on the foot, with sufficient ease across the joint. In stout work it is indispensable that the whole of the boot or shoe should be above the measurement of the foot. The labour of bending stout material is considerable, and if the boots are made tight they are exhausting to walk in.

Running shoes are usually made upon an entirely wrong principle. It is the custom to make them very much too short and too close in the fitting all over. A running shoe or any athletic shoe should feel firm upon the foot, give a firm foothold and yet be very easy across the joint. Both these classes of shoes should be quite 5/16ths less than the foot round the instep measure. The joint measure should be a quarter-of-an-inch over the foot. The length should be quite three sizes longer than the foot. The form decidedly the Meyer form.

The alteration required in the girth, length, and shape of lasts is made by fittings ; these are made from gutta-percha or leather ; the latter appears to be the most convenient. They should be produced upon a method so that they could be identified at any time.

The fittings in common use are joint, instep, waist, sole-pieces, long-stop, short-stop, counter, long heel-pins, short heel-pins, and toe pieces. In addition to these there are a number of pieces used for fitting up very tender parts, such as corns, bunions, and specially tender places. The various fittings, with their shape, are shewn upon Plate 8. The method of applying them is shewn upon Plate 9. Figure 1 has a long-piece placed upon the outer side of the last to increase its width and girth. The heel-pin (5) is a short heel-pin which increases the length and long heel girth but not the width of the seat. In Figure 2 the long heel-pin (6) increases both the length of the last and the width of the seat. The waist-pad (8) deadens the outside waist and increases the instep girth. Upon Figure 4 the corresponding waist fitting (7) is shewn, which also increases the instep girth and deadens the inside waist. It must be evident that where no increase of heel measure is required, but some increase in the instep girth, that to add an instep fitting on the top of the instep cannot be correct, because when we use a fitting such as Nos. 2 and 4, we not only increase the instep measure, but the long heel measure as well. The object would be much better brought about by using fittings as No. 7, 8, or 14. The latter number is a very useful fitting where the waist is very dead. Joint girths may be altered in a similar manner by putting pieces across the bottom of the last, increasing the roundness and toe spring, as Fitting 9. The waist may be deadened and the seat made more round by fittings, as 13. Tender places, as corns, should be fitted up with pieces not less than one inch wide. A single corn, as fitting 16 ; where the bottom of several toes are tender, by a fitting as G. If the toes upon the top part of the foot have corns, a fitting corresponding to G would be placed upon the upper part of the last ; but about one inch behind the lower fitting, to provide for the bending of the toes. Bunion pieces should be fitted up as 10 and 11. The side bunion piece should commence behind the root of the great toe, reach its greatest substance over the joint, and then bevelled

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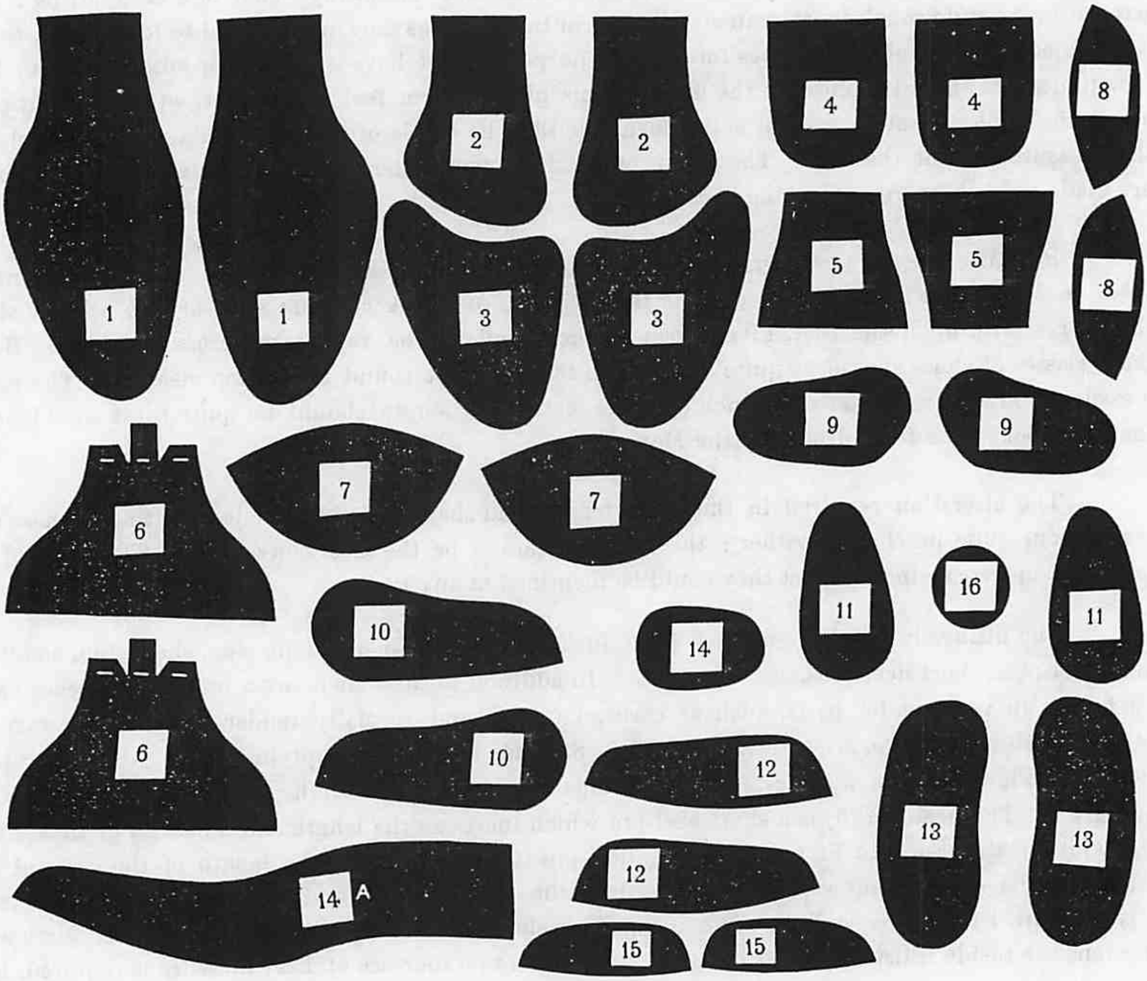
Plate 8.



A Set of Fittings.

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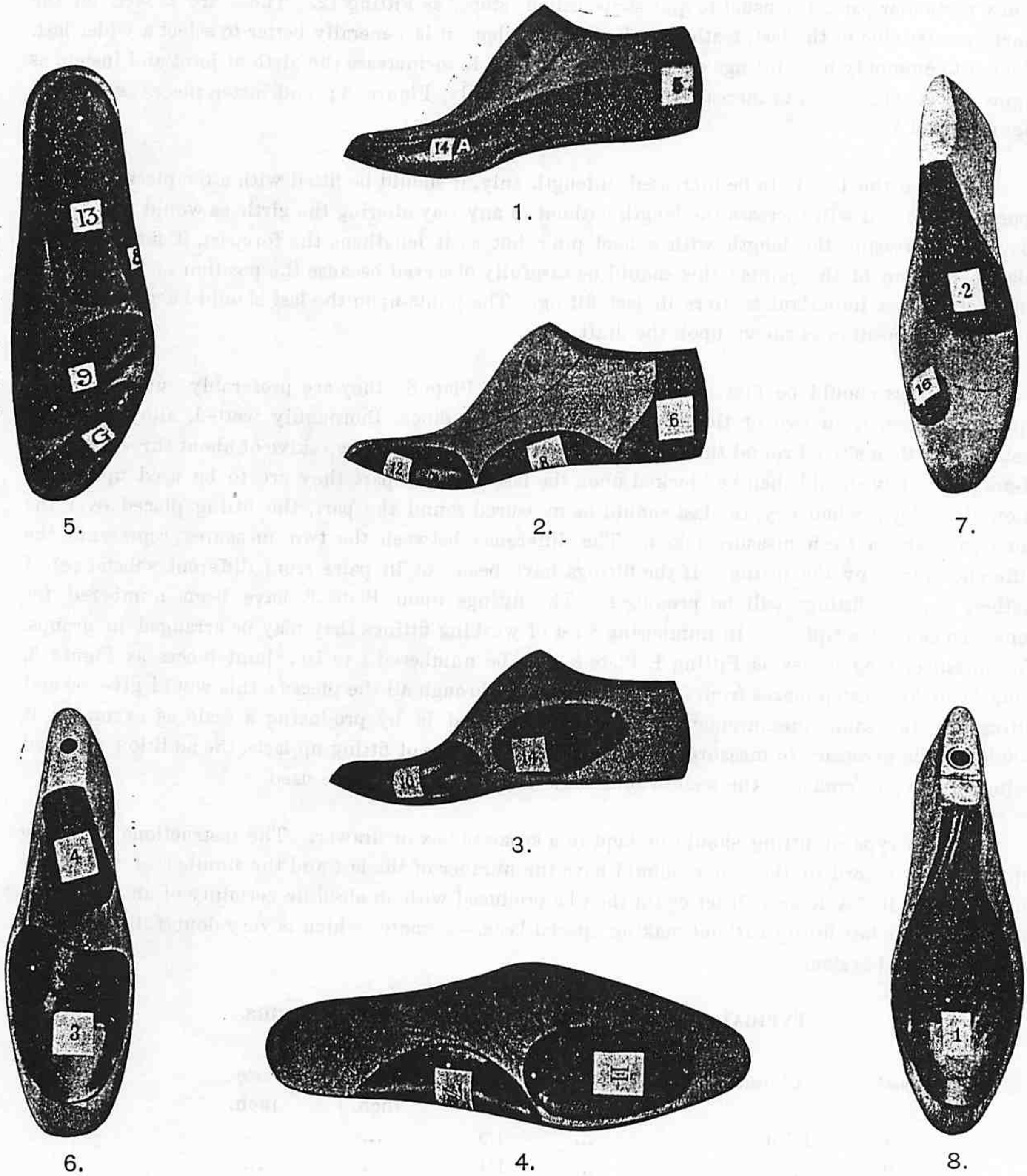
Plate 9.



The position of the Fittings on the Last.

off to the end of the great toe. The last should also be fitted up at the bottom, as Fitting 11, to allow the bunion joint to bed into the bottom of the boot. For the purpose of widening the tread of the last or of any particular part, it is usual to put strips called 'stops,' as Fitting 12. These are tacked on the inner or outer side of the last, feathered off to a fine edge ; it is generally better to select a wider last. The most commonly used fittings are the long piece No. 1, to increase the girth at joint and instep, as Figure 8. A joint piece, to increase the girth at joint only, Figure 6 ; and instep pieces as 2 and 4, Figures 6 and 7.

Where the last is to be increased in length only, it should be fitted with a toe piece as shewn upon Plate 7 : this will increase the length without in any way altering the girth, as would be brought about by increasing the length with a heel pin ; but as it lengthens the forepart, it may alter the relative position of the joints : this should be carefully observed because the position of the joint is one of the most important matters in last fitting. The joints upon the last should be precisely the same relative position as shewn upon the draft.

Fittings should be first cut out, as shewn upon Plate 8 : they are preferably cut in pairs of equal thickness, from two or three substances of bottom stock, thoroughly wetted, allowed to dry mellow, and then skived round the edge upon the flesh side, with a deep skive of about three-quarters-of-an-inch ; they should then be blocked upon the last over the part they are to be used upon, and allowed to dry ; when dry, the last should be measured round the part, the fitting placed over the same part, and a fresh measure taken. The difference between the two measures represents the difference made by the fitting. If the fittings have been cut in pairs from different substances of leather, a set of fittings will be produced. The fittings upon Plate 8 have been numbered for convenience of description. In numbering a set of working fittings they may be arranged in groups. For instance, long pieces as Fitting 1, Plate 8, may be numbered 1 to 10 ; joint pieces as Figure 3, from 11 to 20 ; instep pieces from 21 to 30, and so on through all the pieces ; this would give several fittings of the same measurement. A simpler method is by producing a scale as example : it would not be necessary to measure any fittings in the process of fitting up lasts, the addition required being known ; reference to the scale would show what fitting should be used.

Each type of fitting should be kept in a separate box or drawer. The instructions for fitting up, with the record of the order, should have the number of the last and the number of the fitting marked upon it. A Repeat Order could then be produced with an absolute certainty of an exact copy of the previous last fitting without making special lasts,—a matter which is very doubtfully achieved under the usual system.

Typical Arrangement of Sets of Last Fittings.

				Increase made.	
Number.	*Character.*		*Joint.*	*Lower instep.*	*Instep.*
			inch.	inch.	inch.
1	Joint	...	1/8	...	...
2	...	...	1/4	...	...
3	...	...	3/8	...	...
4	...	...	1/2	...	...
5	Long piece	...	1/8	1/8	1/8
6	...	...	1/4	1/4	1/4

Number.	Character.		Joint. inch.	Increase made. Lower Instep. inch.	Instep. inch.	
7	Long piece	...	3/8	3/8	3/8	
8	...	...	1/2	1/2	1/2	
9	...	...	1/8	1/4	1/4	
10	...	...	1/4	1/8	1/8	
11	...	...	1/4	3/8	3/8	
12	...	...	3/8	1/2	1/2	
13	Short instep	...	...	...	1/8	
14	...	...	...	...	1/4	
15	...	...	...	...	3/8	
16	...	...	...	...	1/2	
17	Long instep	...	...	1/8	1/8	
18	...	...	...	1/4	1/4	
19	...	...	...	3/8	3/8	
20	Inside waist	...	...	1/8	1/8	
21	...	...	...	1/4	1/4	
22	...	...	...	3/8	3/8	
23	Outside waist	...	...	1/8	1/8	
24	...	...	...	1/4	1/4	
25	Tread piece	...	1/8	...	...	
26	...	...	1/4	...	...	
27	Heel pin	...	...	...	...	Length—1/4 size.
28	...	...	...	...	...	„ 1/2 „
29	Inside counter	...	...	1/8	1/8	
30	...	...	...	1/4	1/4	
31	Outside counter	...	...	1/8	1/8	
32	...	...	...	1/4	1/4	

A great deal of peculiar apparatus has been invented for taking the shape and measurement of the foot. Very little of it has been of any practical use. It has been found that the mechanical methods which may be very valuable in recording the shape of rigid objects, are of very little utility of recording the shape and measurement of a plastic object like the foot. Therefore the draft, impression, size-stick and location tape are still the most reliable apparatus.

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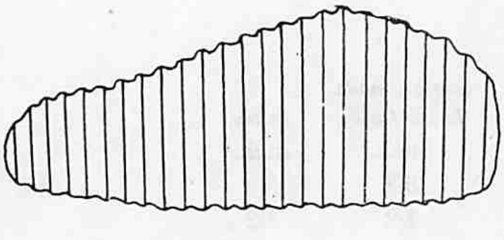
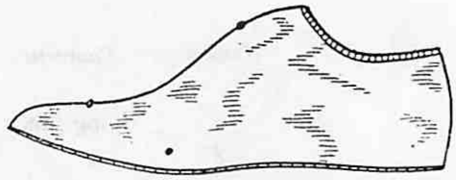
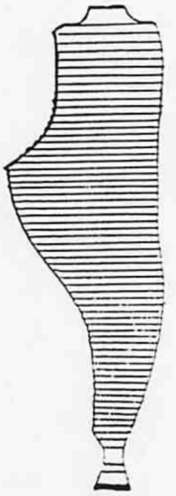
Plate 10.



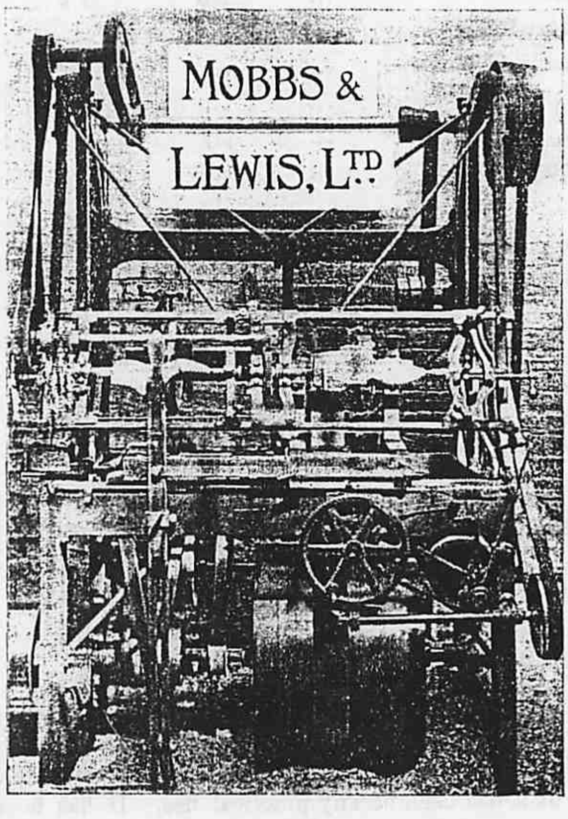
Rough Turned Block.



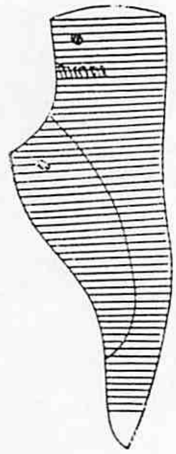
Turning Pattern.



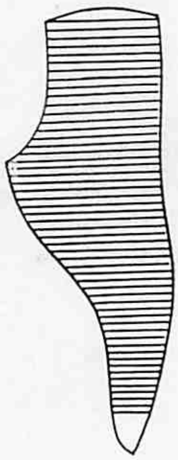
First Turning.



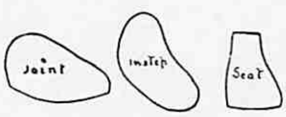
Turning Machine.



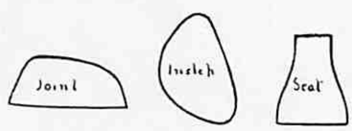
Bored & Cut Down.



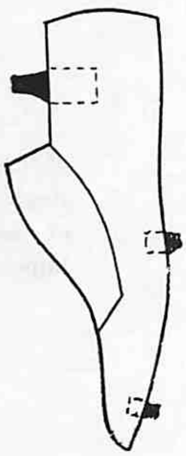
Toe'd & Heel'd.



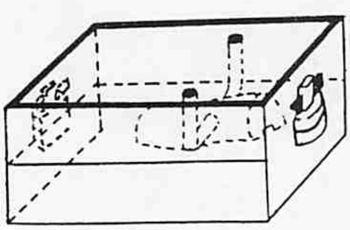
American Section.



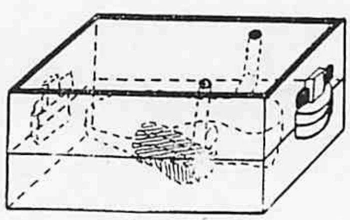
English Section.



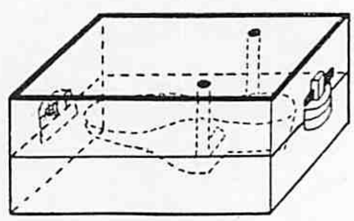
Casting Model.



Moulding Block.



Casting Bottom.



Moulding Last.

CHAPTER IV.

Last Making and Measurements.

LAST MAKING, entirely by the hand process, has been superseded by the use of machines in last manufacture. Nearly all the processes are now executed by machine, or by the aid of machine tools. The last maker now being a pattern maker, his occupation consisting entirely of the production of wood blocks, to be used as patterns in last turning machines. These patterns are ordinary wood lasts that have their edges protected by rows of nails as the Diagram on Plate 10. The points of measurements round which the dimensions are to be taken, are located by nails driven into the lasts. The illustration represents the operation of turning the lasts. The rough turned wood block is centred in the machine opposite a pattern or dummy. A rocking bed or frame carrying a block which rotates against the pattern has its counter part in the form of knives, which rotate against the rough block. The pattern and the block both revolve together, while the dummy block and knives travel along the machine. As the pattern acts upon the dummy according to its shape, and the knives cut up the block as the dummy travels, the result is that a turned last the shape of the pattern is made by the machine. Hitherto the machines have produced a copy of the pattern from the toe to the heel: they have not yet been adapted to make toes and heels. By the kindness of Messrs. Mobbs & Lewis, Kettering, we are enabled to shew a view of this machine.

After the last is turned, the toe and heel have to be made. This may be done by hand, or preferably, by machine. The hand method is shewn on Plate 11; this also represents the manner in which lasts are made entirely by hand. The knife being essentially the same as a last maker's knife, but the block differs slightly in its shape and arrangement. The machine method of making toes and heels consists, for the toes, of a template working in conjunction with a saw, so that precisely the same toe is produced automatically. The heel is shaped by the last being placed upon a swinging table, which moves in the form that the seat of the last is desired to be. The result is a perfect reproduction of the original last. The next operation is sawing down the block, boring the holes to hang the last up by, and for putting the block fastener in, making the socket holes for the insertion of the laster's upright, and where a plate is wanted, fixing on the sole, or seat, plate. The last then presents the appearance as Figure 5, Plate 10.

If it is intended to form a pattern for casting lasts, it is made the shape shewn in Figure 6, which also shews the core boxes required in casting iron lasts. Figures 7, 8, and 9, shew the method of casting iron lasts. The moulding boxes are made in two parts, perfectly fitted; one side of the box is filled with sand, the model is then placed upon it; the other side of the box then placed in position, filled in and rammed tightly, and turned completely over. The first side is taken off and the sand taken out, so that the model can be withdrawn. The other side is then put on and tightly packed with sand. Runner holes and channels are made and the molten metal poured in. This produces the block. The body of the last is cast over the block. Figure 7 shews the position of the mould of the last after the operation which has been described has been repeated with the lower part of the last. Figure 9 shews the manner in which the actual casting is taken. The mould having been

secured of the entire last, the block is then placed in the position that it will occupy in relation to the last. The molten metal is then poured down the holes, filling up the cavity of the mould not occupied by the block, thus securing a perfect fit between last and block. In all these operations parting sand is used to assist in releasing the last from the mould and from the block.

Models should be made about half a size longer than ordinary lasts, to provide for the shrinkage of the metal when cooled. It is not necessary to make them any larger in girth, because in tapping the pattern to release it the moulder naturally makes a difference, which compensates for the shrinkage of the metal in girth.

Hand-made lasts are generally made from the block. These blocks (Plate 11) consist of triangular spokes, which are sections of boughs or trunks of trees. After careful drying, they are chopped roughly into the shape of the lasts (see Figures 1 and 2). The next operation is knifing over, which consists of cutting the wood down to a rough representation of the last to be made, but about a size longer and half-an-inch larger in fitting. It is afterwards knifed down to nearly the shape and size as Figure 4, and cut down and bored as described in machine last making. The final shaping is produced by rasping, which takes out the knife marks, shapes up the toe and all important points ; the marks left by the rasp are taken out by a scraper ; the marks left by the scraper are removed by the use of glass paper,—sometimes the lasts are burnished with a bone and sometimes they are varnished.

A great many different kinds of wood are used for last making, but the best are beech, charme, persimmon and bird's-eye maple. Clog soles are generally made from the alder, and sabots or wooden shoes from beech. For last making, a wood is required that will work easily under the knife, will be hard and tough in the wear, and not very liable to split. It should take a good finish, be free from knots, and not very liable to draw moisture or shrink and swell. No wood has quite all these qualities, but English beech, French charme, and bird's-eye maple come very near. Beech, which is commonly used in England, has a brown tinge of colour, is fairly close in the grain and easily worked. Charme is a much heavier wood, white in colour, very free from knots and very tough ; it usually reaches here from France in a better condition than English beech blocks, and is, consequently, generally of a higher quality. Maple is a fine close whitish wood from North America, with the bird's-eye maple markings, which give it its name. It produces very handsome looking lasts which polish up to a very high lustre, and is the favourite material among the American and some English makers ; the rough turned blocks are imported here in large quantities. Persimmon is very similar to beech in colour, but in character, although darker, very like French charme ; it is imported from the Southern States of North America.

All these woods have a common peculiarity : the centre consists of a core or pith which is of no use in last making, next that is the heart of sap wood and then the bark (Figure 1, Plate 11). Rings called annular rings denote a year's growth counting from the centre, these growths are smaller in their distance apart as they approach the bark. By tracing their presence in the lasts we can ascertain in what direction the last is likely to shrink. All trees and blocks or spokes shrink in the direction of the bark, that is the same way as the direction of the annular rings. Therefore, if a last is made with the bottom in the direction of the annular rings, or the bark, it will shrink across the bottom. If cut in this way it is called a bark-bottom last. If cut with the side towards the bark it will shrink in height and is called a bark-sided last. A few bloc'.s are neither bark sides nor bark bottoms, being arranged in an angular direction.

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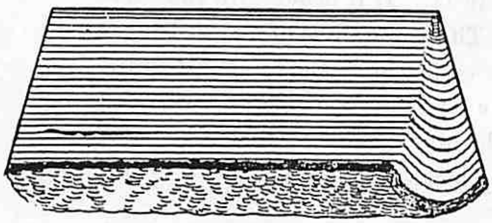
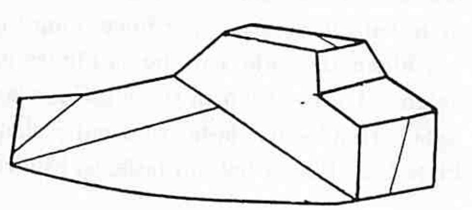
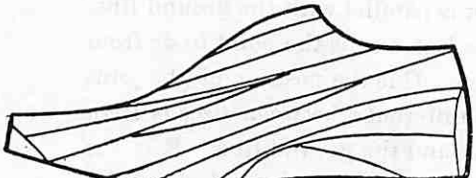
Plate II.



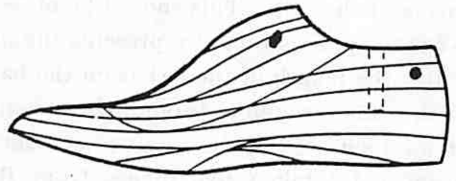
Rough Spoke.



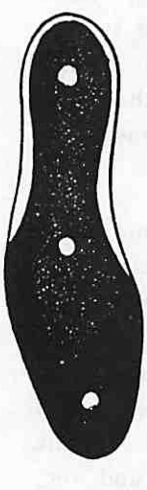
Rough Chopped Block.



Knifed Over.



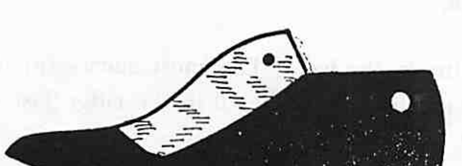
Knifed Down.



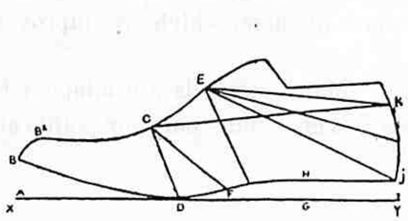
Plated Bcttom.

Toeing and Heeling by Hand.

Welted Last.



Iron Last—Wood Block.



Points of Lasts.

Where the last is arranged with the bottom towards the bark, the curvature of the last produces markings, as shewn at Figure 4, Plate 9, and Figure 5, Plate 11. If it is cut with the bark-to the side, it has the appearance along the side as Figure 2, Plate 10. The appearance of a bark-bottom last along the side will be as Figure 9, Plate 11. Seeing that it is easier to remedy a defect in the height of a last than in the width, it is desirable that we should have a large proportion of bark-sided lasts. Hand-sewn lasts are usually shaped as Figure 2, Plate 12. Machine welted lasts as Figure 5, Plate 11. Plated-bottom lasts, as Figure 7, and iron lasts with wood blocks, as Figure 8.

There are certain terms in connection with lasts which the student should understand. Figure 9, Plate 11, will help to explain these. The line X Y represents the ground upon which the last stands. The distance A B, which the toe of the last is above the ground line, is termed the toe spring of the last. This should be measured when the seat of the last is parallel with the ground line. B 2 is the puff point; it represents the highest point of the toe of the last, and is the point to or from which the length of the last from the back of the heel should be taken. C is the position of the joint girth—this is taken at three inches from B 2 for size 5's adults. The difference between sizes is 1/9th of an inch. D is the point of contact between the tread of the last and the ground line. E is the instep point taken five inches from B 2 for size 5's. The difference between size and size 1/6th of an inch. This measure should be taken straight round the waist of the last. The least measurement that can be secured is the correct measure over that part. C F is the waist measure commonly referred to in American last making, but very rarely used. G H is the pitch of the last; this is determined first by arranging the seat parallel with the ground line. The height of the point H determines the height of the heel, suitable for that last. It would represent the relative elevation of the heel above the ground in the finished boot. The curve D H is the waist spring. The degree of this spring determines the relative size of the measurement C F. I J is the height of the heel, which also represents the pitch. K is the counter point. C K the counter line. The upper part of the last above the counter line, as C E L, is termed the comb of the last. E J is the long heel. These represent the terms which define the profile of the last. The shape of the bottom of the last is generally referred to as the range; see sole shapes. The sectional form of the last is shewn on Plates 10 and 11.

The English section is particularly suitable for stout work. The sides of the lasts are rather square. The instep point is situated nearly in the middle of the last. The seat is nearly both sides alike. The cross section of the bottom is rather flat. The American type last is much more prominent on the inside joint, that part being much thicker and rounder than in the English last, and the outside joint thinner. The instep point inclines towards the inner side. The inside counter being thick, as advised in last fitting. The back has each side of a distinct character. The inner side is nearly vertical. The counter is hollowed out on the outer side and the edge of the heel very prominent. The sole is rather rounder than the English last. The typical French last is very round and very straight, it is shewn upon Plate 13; the joint has the thickest part of the last in the centre; the instep has its highest point also in the centre, but is rather thick at the sides; the seat is even sided as in the straight last; the bottom of the last is very round, when seen in profile the seat has a ball nearly approaching the actual shape of the heel, it produces a very close-fitting boot. This description represents the types which originally represented certain styles, but last-makers now make combinations of these, which are improvements upon any one type.

Many methods are adopted to produce style and fitting in the last. The most successful of these is where some point or points are accentuated. An instance of this is shewn in the ridge last—

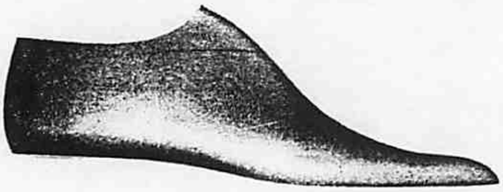
Plate 12. The substance of the last along the small toes is made rather fuller than usual. The last is then cut away from the path of the small toes to the sole of the last and across the top, producing a ridge, which travels from the side of the outside joint to the top of the puff. This ridge, while providing for the foot, also accentuates the shape of the boot. Although very conspicuous on the last and shewing fully on the puff in the finished boot, it is a great deal modified at the side of the joint when the last is withdrawn from the boot. The ultimate effect is to produce a smart toe and good fitting outside joint ; it is one of the methods of securing an extra girth without the appearance of a full fitting. The drop toe last is a representation of the inner side of the boot after considerable wear. Although peculiar in appearance as a last, the goods produced upon it have met with considerable favour. Among a certain class of people, style, even if peculiar if combined with fitting qualities, always meets with approval.

Lasts have to be constructed so that their relation between the ground and heel that it is intended to place upon the boot shall produce a perfect relation between the bearing surface of the heel, the ground, and the forepart of the boot or last. This is illustrated upon Plates 12 and 14. The relation between the last and the Louis or hydraulic heel has to be arranged to secure a perfect blend between the curve of the heel and the curve of the last in the waist and seat, combined with the position of the heel in relation to the length of the last that secures an accurate pitch. The connection between the last, the heel, and the boot, will be seen in the illustration.

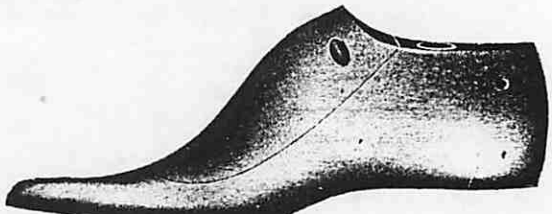
Although lines are used in explaining the relative terms, the student should be able to judge a last by inspection only. The relative pitch, spring and form of profile, are shewn in the boot and shoe lasts on Plates 12, 13, and 14. It will be seen that in each case the seat of the boot last is parallel with the ground ; the spring of the forepart from the point of contact may be in a straight line for very light walking work, may be curved upward for free walking or for stouter work, or may even be carried down at the toe end where some special peculiar style is wanted. The shoe last should unquestionably be longer in the forepart, i.e., with the point of contact nearer the seat, should have much less waist spring and should be full along the sides of the waist. It is usual to thin the shoe last away above the counter, with the idea of securing a close fit in the quarters. The instep point is commonly made much higher, with the object of retaining the girth measurement with a thin counter. It is highly probable that a better result will be obtained if the comb of the last was made lower, but thicker, and the counter of the last above the counter point at the seat was made very thin. This would obtain a small counter measurement, small long heel measurement, and would make better shoes. Slipper lasts have the points of a shoe last essentially ; they should be quite dead in the waists. The distance between the seat and the contact points should be quite a quarter-of-an-inch less than in a boot last, and the forepart correspondingly long. The comb of the last should be low and thin, and the whole of the portion above the counter should be thinned off. There should be a good front spring.

The toe spring of a last should vary with the class of work. The amount of spring could be tested by raising the heel the desired height. For very light work for dress purposes 3/8ths-of-an-inch spring may be used, but for walking purposes, even of the lightest kind, quite half-an-inch spring should be put in the last. For ordinary shooting boots, a three-quarter-of-an-inch spring may be considered moderate. With each increase of substance additional spring is required. For heavy navvy boots, one-and-a-quarter-inch spring is often used. In dealing with this matter, we have to take into consideration the requirements of fashion. It is sometimes very fashionable to wear boots

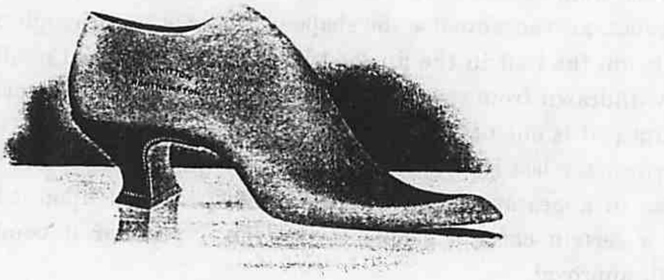
Plate 12.



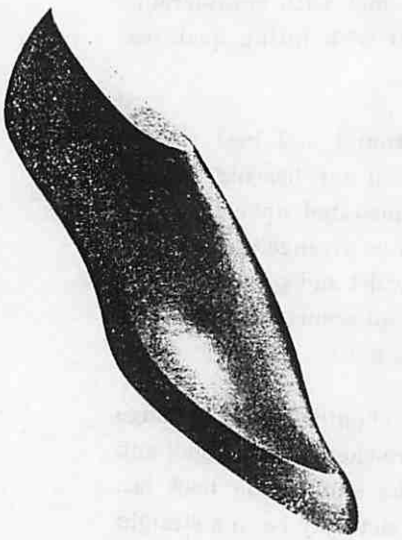
Tennis Shoe Last.



Boot Last.

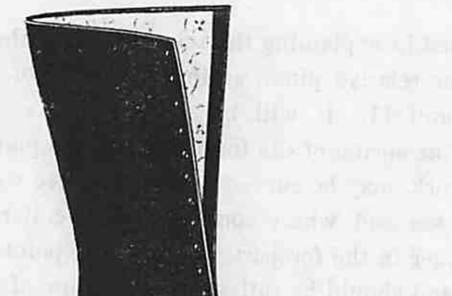


Louis Heel.



Ridge.

Continental.



Boot made on above Last.

From Specimens made by
R. WHITTON,
Castilian Works,
NORTHAMPTON.

with practically no spring; at other times an excessive spring is put into all kinds of footwear. The above amounts represent a rational allowance.

Seeing that the contact of any kind of footcovering appears to have a tendency to turn the small toes towards the middle line of the foot, lasts made upon strictly hygienic principles are rarely required for adult wear; but there is a decided tendency to use them in the production of children's work. This type of last is illustrated by Figure 1, Plate 13. It is a near approach to the ideal form of foot, as near as practically required. This form is decidedly the Meyer form, with some extra width across the toes; the inner margin of the last is nearly straight. This is correct for a child's last, but would not suit the average adult. As stated in the anatomy of the foot, the inner joint becomes prominent as we raise the heel and as the foot develops towards maturity. The instep of this last should have a fair rise of instep; it is a common mistake to make small size lasts with very little difference between the joint and the instep. In many cases the infant foot has a considerable difference between the joint and the instep, owing to the tendons being full upon the instep and the muscles of the sole not much developed. The outer curve of this last would provide for a medium type; usually, there is too much slope back from the inner side of the toe; most infants' feet are rather square at the toes, the long great toe often seen on adult feet appears to develop during childhood: infants' lasts should be as shewn, nearly square.

Figure 2 represents the "Little Gent.'s" type of lasts, providing for a certain degree of smartness in appearance. This is no disadvantage, if provision is made for the parts of the foot that are bony—as the roots of the toes, the bony parts of the waist and the heel; with this provision, some curvature can be put in the last without causing any discomfort. This principle has been carried out in the last illustrated. The full inside counter, bold curve of inner joint and depth of substance, provide for the ball of the foot; as the prominent outer joint provides for the small toes. A student must, to become practically proficient, train his eye to judge lasts by the balance of their parts; the whole matter is relative, a matter of proportion between the substance of the points.

The profile in Figure 2 should be compared to Figure 3, and the difference, in the depth of the last along the side, noted. By then comparing the outer sides, the differences will be apparent. All lasts should be deeper on the inner than the outer side. Again, the inspection of the sides forms a method of judging the points of the last as to its suitability for the requirements of machine operations. Mention has been made of the pitch of a last; by carefully inspecting and comparing both sides, the truth of the range of seat can be ascertained. For the purpose of machine heeling, the last should be quite true in pitch of heel, and level in the seat. The profile from the corner of the seat to the back should be in a straight line, and the inner and outer corners should be in the same plane as the tread; that is, when the last is held bottom up, with one corner of the seat level with the joint on the same side, the other corner should be level with the opposite joint. Figure 3 is a good illustration of the correct range of profile.

Mention has been made of the relative length of lasts, that the true length is determined by the position of the highest point of the puff; exception may be made to this in the case of a last of the type shewn in Figure 4; the puff in this case is carried sufficiently high to permit the toe being accommodated a considerable distance nearer the end of the shoe than the top of the puff. This last has a ridge that is carried to the inner side at a height that allows the toes to be accommodated without the extra edge of the ridge; this is put primarily to give style to the shoe, but as it is in

addition to the girth, the actual length would be taken from the curve of the toe, where it is about half-an-inch thick.

Figure 5 represents a special type of last commonly used for shoes intended for India and Egypt; the style is also in favour upon the Continent, the last being very much used in France; and, having the round section on the top part usual in that type, although very flat in the sole. In fact the forepart is very straight in its outlines, the lines from the ball to the sides of the toe being quite straight; the lower edge is also straight; the whole effect being to give a straight slim appearance to the forepart. The length, as measured by the size-stick, is quite two sizes longer than the standard measurement. A size 8, or 42 Paris points, measures size 10, or 44½ Paris points. Mention might be made here that the socket plate at the top of the last is of leather, which has many advantages over the metal plate.

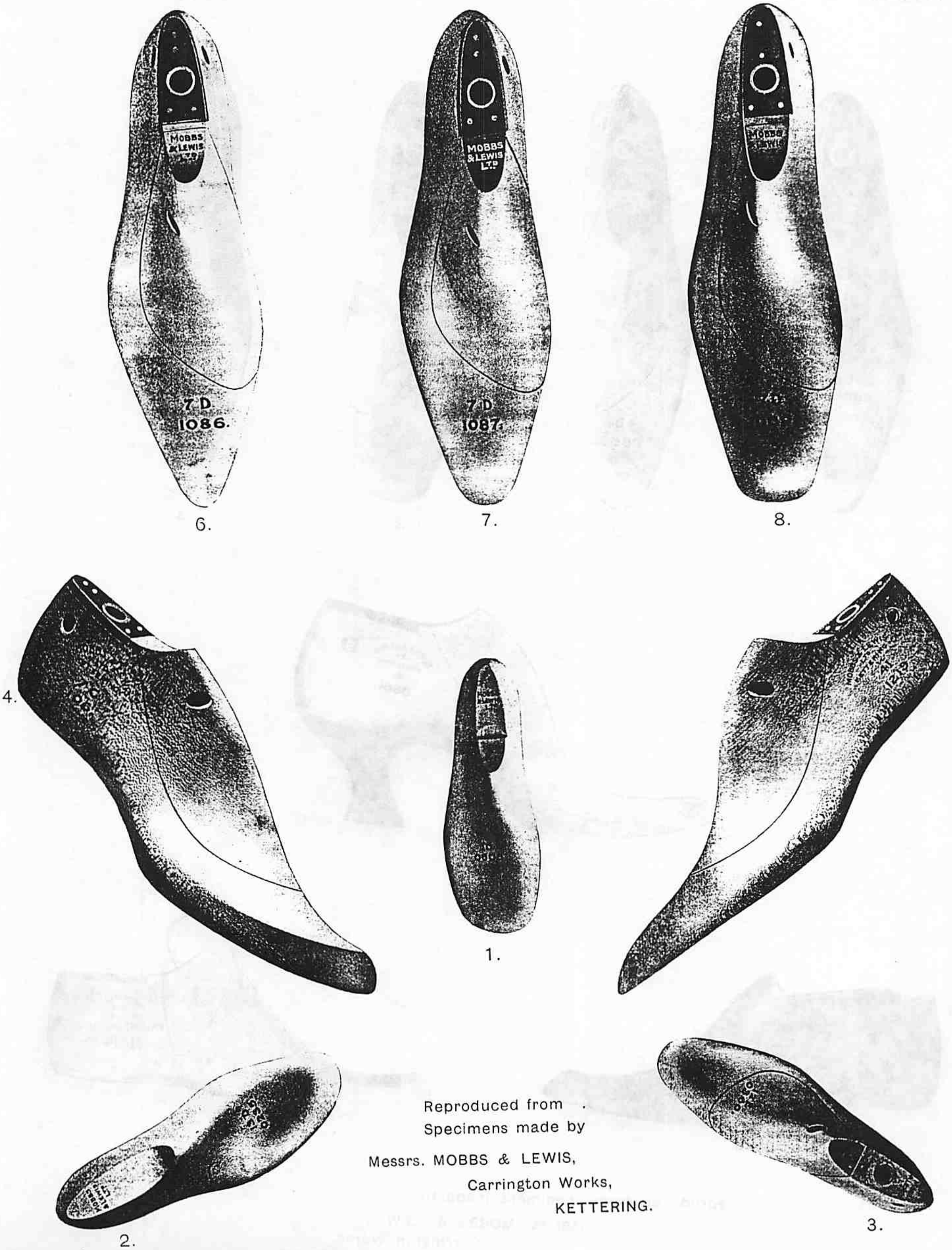
The grade of toes illustrated by Figures 6, 7, and 8, are usually produced in six widths. The practical result is, that provision is made for that number of types of feet, as must be evident by the difference between the curves from the joint to the sides of the toes. But seeing that fashion usually dictates the shape selected by the wearer quite as much as the actual needs of the foot, the alteration in slope at tread is not made in a set. For the purpose of manufacture, the back of the last behind the tread is kept constant in all widths of toes, the difference being represented by the forepart only. If one type of foot only was provided for, the substance of the last would be precisely the same in all the set of toes, the only difference being that the edge would be carried out to form the various widths of toes.

Plate 14, Figures 1, 2, and 3, represent the corresponding grade of toes in ladies' lasts. The distinction between these and men's lasts is that the lines are rounder and less "mannish," much as the difference between ladies' and men's hats. There is more curvature in the waist, the centre point of the puff is nearer the centre of the last than in men's, the instep is brought up higher and cut thinner: there is a general lightness and smartness that is not expected in the same degree in men's lasts.

Figure 4 is a last built to produce a smart shoe, with large fitting measurement. All the essential points of the foot that need extra room are provided for in this last, and the essential shape is still of the order of "the smart." The curve of the waist is designed to carry a high heel, to compensate for this, and to keep the fitting and shape retaining qualities, the last is made full along the counter. The student should be accustomed to observe the line between the great toe joint and the side of the heel; in this case it is nearly straight. Upon the outer side the last swerves outward in the counter, providing for the lower outer ankle, commonly found in feet of the type this last is intended for. These two points, the full inner line of counter and the bold outer curve, make for a good fitting shoe. The extra thickness across the path of the smaller toes and the curve of the sole, provide space that would not cramp the most tender foot. This last should be carefully studied, it has the essentials of a good shoe last, with the curves required to produce a good appearance. It will provide smart shoes for bad feet.

Despite the theories of the learned, fashion constantly returns to the high heel and the curved waist of our ancestors. The Louis heel is rapidly becoming more fashionable than ever. The difficulty in designing this last is to preserve the shape of the waist, with a good fit in the instep.

Plate 13.



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Carrington Works,
KETTERING.

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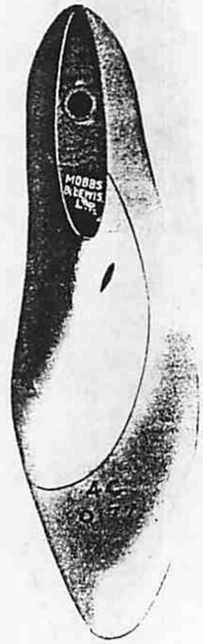
Plate 14.

1.

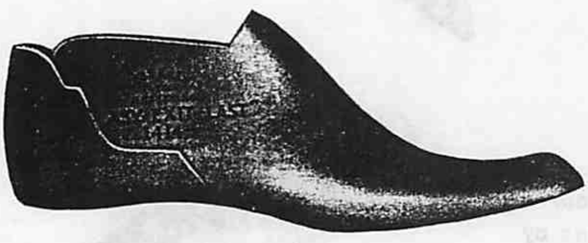
2.

3.



4.

Louis Heel.



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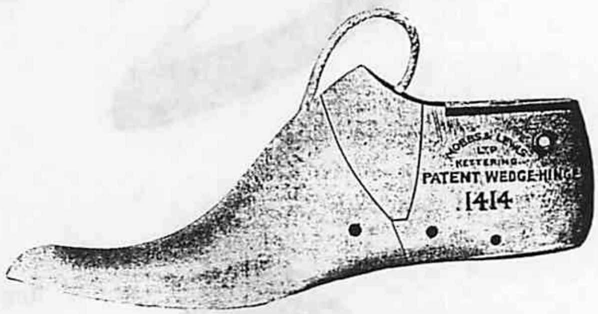

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This can only be secured by retaining the true line measurement. In the last illustrated, in Figure 4, the waists are kept full and the last cut away above the counter, this results in a comb that has the desired bold curve. The forepart has the point of contact rather forward on the inner joint, as is required by the foot; the curve between the centre of the heel and the joint should be kept as full as possible in the middle of the waist. The joint has an abrupt ridge between waist and joint, this is again for the purpose of getting style and smartness; in practice, there does not appear to be anything objectionable in it.

Figures 6 and 7 are representations of what are usually termed "easy exit" lasts. There can be no question of their utility, in fact there is no doubt but that the use of these has made it possible for the uppers to have a curvature at the back that could not be made with the solid lasts. In the case of shoes, and of boots that are lasted by anything but the most expensive labour, there is an enormous advantage in some form of last that permits of being withdrawn without putting the shoe out of shape. The Wedge Hinge last is designed for welted work; as is apparent by its profile, it is a practically solid last until the wedge is withdrawn, the last then turns on the hinge in precisely the same direction as the bend of the shoe, and as the heel turns upward, becomes shorter and more curved, and permits of being withdrawn without bending the shoe; in fact, the last is bent instead of the shoe.

The "Easy Exit" is a well-known example of what are sometimes termed broken lasts. This last is probably the most successful attempt to solve the problem of finding an attachment that would hold the different parts of the lasts while being worked upon, and which would easily unlock when it was required to be removed from the boot. This last consists of two distinct parts, the heel and the front, these are locked together across a section that forms a bearing surface strong enough to stand any hammering, of a shape that slips easily when unlocked, and with a locking contrivance that is quite solid. In the working, the last is used as all other lasts, the difference being, that when taking it from the shoe the fastening is loosened by a spike being thrust into an aperture, and as the heels come completely away, the shoe and the forepart of the last is pushed straight off the heel, leaving it on the upright, the forepart is then taken out of the shoe without disturbing its shape in any way.

Standard measurements should represent the average requirements of the foot of each distinct type for the different classes of work and for national peculiarities. Much may be determined by the use of bespoke methods in the matter of measurement, shape and type. The method of determining these measurements does not differ from taking bespoke orders, except that the measurements should be taken from one size of foot over a large variety of fittings; the measurements produced should be arranged in groups, to determine the average. The impressions and drafts are treated in a similar manner. From these averages in both measurement and form the standards are produced.

Different countries have different units of measurements. The English-speaking people use the yard and its sub-divisions for the determination of the measurements of footwear, but there are some peculiar customs in numbering the sizes, and in the position of zero point; also there are some differences in the divisions of the inch used for girths and lengths. Practically one-third-of-an-inch (called a size) is used in determining the difference in lengths; this is sometimes divided into two, and thus we have a size and a half size. The zero point from which these sizes are numbered is at four inches from the commencement of the measure; therefore size 1 measures four-inches-and-one-third, the numeration is continued to size 13 and re-commenced over again—thus size 1, adults,

measures eight-inches-and-two-thirds. This is unquestionably a great defect, and it would be far better to continue the numeration, continuously, without the break between the childrens' and the larger sizes. The American zero point is at one-twelfth nearer the beginning of the tape than the English, and naturally all the other sizes are one-twelfth short of English sizes. For girth measurements various units are used, all sub-divisions of the inch; 2/9ths, 3/16ths and 1/4th-of-an-inch are used. Each of these are adapted to secure certain differences between sizes, to preserve the character of the fitting throughout the whole of the sizes. For widths, 1/9th, 1/12th, 1/16th and 1/8th are used for joint widths, and smaller sub-divisions for widths of seat and waist.

All other countries use the metre as the standard measurement and its sub-divisions for lengths and girths. The centimetre is used for girth measurements sometimes divided into two or other smaller divisions. There appears to be quite as much uncertainty about the most desirable unit in countries using the metre and the decimal system, as there is among English-speaking people. Some Continental manufacturers use half-a-centimetre for the difference between sizes; others use two-thirds of a centimetre as representing a size: this is usually called a Paris point. Where the centimetre is used for lengths, it is generally divided into half-centimetres. The only apparent advantage of the Continental method, is, that the numeration commences at the zero point and is continuous right along the measure. The comparative lengths of the various units are shewn in the diagram representing the tool upon Plate 19. This tool shews the comparative length of English sizes, English inches, the centimetre and Paris points. It will be seen that the zero point on our size-stick is at four inches, *i.e.*, very near ten centimetres and 15 Paris points. The practical difference is that ten centimetres are one-fifteenth of an inch shorter; five centimetres are one-thirtieth less than two English inches. From this an approximate comparison can be made between dimensions in Continental units and in the English. Size 8's adults, English size, practically coincides with size 42, Paris points; size 5, English, is practically size 38, Paris points. The other sizes which are very nearly equal may be traced upon the scale shewn.

There have been several proposals for improving the method of recording the dimensions of the foot and of lasts. The principle aimed at is to secure some method of measurement that will give a sufficient number of sizes to accommodate lengths, and will also produce differences in sizes, that, starting from a standard measurement, all the sizes in the set will be according to the average requirement of the foot. At present we cannot say that we have achieved this. It would appear that the simplest way would be, first to determine the length, girth and width of two distinct sizes, preferably a child's and an adult's: then to divide the measurements between each, into the number of sizes required; the unit found in each case will be the unit of measurement. Where this has been tried, the result has been that they have obtained fractions of the inch that could not easily be recorded by any of the existing tape measures, and the difficulty of making special tapes being great, very little novelty has come into practical use.

At present the most commonly used method is to make one-third-of-an-inch difference for sizes; a quarter-of-an-inch difference for girth measurements, ; one-twelfth-of-an-inch difference for width of tread, and one-sixteenth-of-an-inch difference for width of seat. These differences in girth appear to be too much, causing the larger sizes to become too full in fitting, and the smaller sizes too small. To remedy this, it has been the common practice to make several sizes in the set of nearly the same girth, usually the 1's nearly equal to the 2's; the 10's to the 11's, and the 6's to the 7's. This

INFANTS', GIRLS', and MISSES'.

	Lengths in Sizes.	1	2	3	4	5	6	7	8	9	10	11	12	13	1
A 1 Fitting	Joint ...	$4\frac{3}{16}$	$4\frac{6}{16}$	$4\frac{9}{16}$	$4\frac{12}{16}$	$4\frac{15}{16}$	$5\frac{2}{16}$	$5\frac{5}{16}$	$5\frac{8}{16}$	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$
	Instep...	$4\frac{8}{16}$	$4\frac{11}{16}$	$4\frac{14}{16}$	$5\frac{1}{16}$	$5\frac{5}{16}$	$5\frac{8}{16}$	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	7	$7\frac{3}{16}$
	Tread ..	$1\frac{7}{12}$	$1\frac{31}{48}$	$1\frac{34}{48}$	$1\frac{37}{48}$	$1\frac{40}{48}$	$1\frac{43}{48}$	$1\frac{46}{48}$	$2\frac{1}{48}$	$2\frac{4}{48}$	$2\frac{7}{48}$	$2\frac{10}{48}$	$2\frac{13}{14}$	$2\frac{16}{48}$	$2\frac{19}{48}$
	Seat ...	$1\frac{4}{64}$	$1\frac{7}{64}$	$1\frac{10}{64}$	$1\frac{13}{16}$	$1\frac{16}{64}$	$1\frac{19}{64}$	$1\frac{22}{64}$	$1\frac{25}{64}$	$1\frac{28}{64}$	$1\frac{31}{64}$	$1\frac{34}{64}$	$1\frac{37}{64}$	$1\frac{40}{64}$	$1\frac{43}{64}$
B 2 Fitting	Joint ...	$4\frac{7}{16}$	$4\frac{10}{16}$	$4\frac{13}{16}$	5	$5\frac{3}{16}$	$5\frac{6}{16}$	$5\frac{9}{16}$	$5\frac{12}{16}$	$5\frac{15}{16}$	$6\frac{2}{16}$	$6\frac{5}{16}$	$6\frac{8}{16}$	$6\frac{11}{16}$	$6\frac{14}{16}$
	Instep...	$4\frac{11}{16}$	$4\frac{14}{16}$	$5\frac{1}{16}$	$5\frac{4}{16}$	$5\frac{8}{16}$	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{25}{32}$	$6\frac{31}{32}$	$7\frac{5}{32}$	$7\frac{11}{32}$
	Tread ...	$1\frac{8}{12}$	$1\frac{35}{48}$	$1\frac{38}{48}$	$1\frac{41}{48}$	$1\frac{44}{48}$	$1\frac{47}{48}$	$2\frac{2}{48}$	$2\frac{5}{48}$	$2\frac{8}{48}$	$2\frac{11}{48}$	$2\frac{14}{48}$	$2\frac{17}{48}$	$2\frac{20}{48}$	$2\frac{23}{48}$
	Seat ...	$1\frac{8}{64}$	$1\frac{11}{64}$	$1\frac{14}{64}$	$1\frac{17}{64}$	$1\frac{20}{64}$	$1\frac{23}{64}$	$1\frac{26}{64}$	$1\frac{29}{64}$	$1\frac{32}{64}$	$1\frac{35}{64}$	$1\frac{38}{64}$	$1\frac{41}{64}$	$1\frac{44}{64}$	$1\frac{47}{64}$
C 3 Fitting	Joint ...	$4\frac{11}{16}$	$4\frac{14}{16}$	$5\frac{1}{16}$	$5\frac{4}{16}$	$5\frac{7}{16}$	$5\frac{10}{16}$	$5\frac{13}{16}$	6	$6\frac{3}{16}$	$6\frac{6}{16}$	$6\frac{9}{16}$	$6\frac{12}{16}$	$6\frac{15}{16}$	$7\frac{1}{16}$
	Instep...	$4\frac{14}{16}$	$5\frac{1}{16}$	$5\frac{4}{16}$	$5\frac{7}{16}$	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{30}{32}$	$7\frac{4}{32}$	$7\frac{10}{32}$	$7\frac{16}{32}$
	Tread ...	$1\frac{12}{16}$	$1\frac{13}{16}$	$1\frac{14}{16}$	$1\frac{15}{16}$	2	$2\frac{1}{16}$	$2\frac{2}{16}$	$2\frac{3}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$	$2\frac{6}{16}$	$2\frac{7}{16}$	$2\frac{8}{16}$	$2\frac{9}{16}$
	Seat ...	$1\frac{12}{64}$	$1\frac{15}{64}$	$1\frac{18}{64}$	$1\frac{21}{64}$	$1\frac{24}{64}$	$1\frac{27}{64}$	$1\frac{30}{64}$	$1\frac{33}{64}$	$1\frac{36}{64}$	$1\frac{39}{64}$	$1\frac{42}{64}$	$1\frac{45}{64}$	$1\frac{48}{64}$	$1\frac{51}{64}$
D 4 Fitting	Joint ...	$4\frac{15}{16}$	$5\frac{2}{16}$	$5\frac{5}{16}$	$5\frac{8}{16}$	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	7	$7\frac{3}{16}$	$7\frac{6}{16}$
	Instep...	$5\frac{1}{16}$	$5\frac{4}{16}$	$5\frac{7}{16}$	$5\frac{10}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	$6\frac{3}{32}$	$6\frac{9}{32}$	$6\frac{15}{32}$	$6\frac{21}{32}$
	Tread ...	$1\frac{40}{48}$	$1\frac{43}{48}$	$1\frac{46}{48}$	$2\frac{1}{48}$	$2\frac{4}{48}$	$2\frac{7}{48}$	$2\frac{10}{48}$	$2\frac{13}{48}$	$2\frac{16}{48}$	$2\frac{19}{48}$	$2\frac{22}{48}$	$2\frac{25}{48}$	$2\frac{28}{18}$	$2\frac{31}{48}$
	Seat ...	$1\frac{16}{64}$	$1\frac{19}{64}$	$1\frac{22}{64}$	$1\frac{25}{64}$	$1\frac{28}{64}$	$1\frac{31}{64}$	$1\frac{33}{64}$	$1\frac{36}{64}$	$1\frac{39}{64}$	$1\frac{42}{64}$	$1\frac{45}{64}$	$1\frac{48}{64}$	$1\frac{51}{64}$	$1\frac{55}{64}$
E 5 Fitting	Joint ...	$5\frac{3}{16}$	$5\frac{6}{16}$	$5\frac{9}{16}$	$5\frac{12}{16}$	$5\frac{15}{16}$	$6\frac{2}{16}$	$6\frac{5}{16}$	$6\frac{8}{16}$	$6\frac{11}{16}$	$6\frac{14}{16}$	$7\frac{1}{16}$	$7\frac{4}{16}$	$7\frac{7}{16}$	$7\frac{10}{16}$
	Instep...	$5\frac{4}{16}$	$5\frac{7}{16}$	$5\frac{10}{16}$	$5\frac{13}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	7	$7\frac{4}{16}$	$7\frac{7}{16}$	$7\frac{10}{16}$	$7\frac{13}{16}$
	Tread ...	$1\frac{11}{12}$	$1\frac{47}{48}$	$2\frac{2}{48}$	$2\frac{5}{48}$	$2\frac{8}{48}$	$2\frac{11}{48}$	$2\frac{14}{48}$	$2\frac{17}{48}$	$2\frac{20}{48}$	$2\frac{23}{48}$	$2\frac{26}{48}$	$2\frac{29}{48}$	$2\frac{32}{48}$	$2\frac{35}{48}$
	Seat ...	$1\frac{20}{64}$	$1\frac{23}{64}$	$1\frac{26}{64}$	$1\frac{29}{64}$	$1\frac{32}{64}$	$1\frac{35}{64}$	$1\frac{38}{64}$	$1\frac{41}{64}$	$1\frac{44}{64}$	$1\frac{47}{64}$	$1\frac{50}{64}$	$1\frac{53}{64}$	$1\frac{56}{64}$	$1\frac{59}{64}$
F 6 Fitting	Joint ...	$5\frac{7}{16}$	$5\frac{10}{16}$	$5\frac{13}{16}$	6	$6\frac{3}{16}$	$6\frac{6}{16}$	$6\frac{9}{16}$	$6\frac{12}{16}$	$6\frac{15}{16}$	$7\frac{2}{16}$	$7\frac{5}{16}$	$7\frac{8}{16}$	$7\frac{11}{16}$	$7\frac{14}{16}$
	Instep...	$5\frac{7}{16}$	$5\frac{10}{16}$	$5\frac{13}{16}$	6	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	7	$7\frac{3}{16}$	$7\frac{13}{32}$	$7\frac{19}{32}$	$7\frac{25}{32}$	$7\frac{31}{32}$
	Tread ...	2	$2\frac{3}{48}$	$2\frac{6}{48}$	$2\frac{9}{48}$	$2\frac{12}{48}$	$2\frac{15}{48}$	$2\frac{18}{48}$	$2\frac{21}{48}$	$2\frac{24}{48}$	$2\frac{27}{48}$	$2\frac{30}{48}$	$2\frac{33}{48}$	$2\frac{36}{48}$	$2\frac{39}{48}$
	Seat ...	$1\frac{24}{64}$	$1\frac{27}{64}$	$1\frac{30}{64}$	$1\frac{33}{64}$	$1\frac{36}{64}$	$1\frac{39}{64}$	$1\frac{42}{64}$	$1\frac{45}{64}$	$1\frac{48}{64}$	$1\frac{51}{64}$	$1\frac{54}{64}$	$1\frac{57}{64}$	$1\frac{60}{64}$	$1\frac{63}{64}$

LADIES'.

Lengths in Sizes.		2	3	4	5	6	7	8
A 1 Fitting	Joint ...	$6\frac{7}{8}$	$7\frac{1}{8}$	$7\frac{3}{8}$	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$
	Instep ...	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$
	Tread ...	$2\frac{5}{12}$	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$
	Seat ...	$1\frac{48}{64}$	$1\frac{51}{64}$	$1\frac{54}{64}$	$1\frac{57}{64}$	$1\frac{60}{64}$	$1\frac{63}{64}$	$2\frac{2}{64}$
B 2 Fitting	Joint ...	$7\frac{1}{8}$	$7\frac{3}{8}$	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$
	Instep ...	$7\frac{3}{4}$	8	$8\frac{1}{4}$	$8\frac{1}{2}$	$8\frac{3}{4}$	9	$9\frac{1}{4}$
	Tread ...	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$	3
	Seat ...	$1\frac{51}{64}$	$1\frac{54}{64}$	$1\frac{57}{64}$	$1\frac{60}{64}$	$1\frac{63}{64}$	$2\frac{2}{64}$	$2\frac{5}{64}$
C 3 Fitting	Joint ...	$7\frac{3}{8}$	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$
	Instep ...	8	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$
	Tread ...	$2\frac{5}{8}$	$2\frac{11}{16}$	$2\frac{3}{4}$	$2\frac{13}{16}$	$2\frac{7}{8}$	$2\frac{15}{16}$	3
	Seat ...	$1\frac{54}{64}$	$1\frac{57}{64}$	$1\frac{60}{64}$	$1\frac{63}{64}$	$2\frac{2}{64}$	$2\frac{5}{64}$	$2\frac{8}{64}$
D 4 Fitting	Joint ...	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$
	Instep ...	8	$8\frac{1}{4}$	$8\frac{1}{2}$	$8\frac{3}{4}$	9	$9\frac{1}{4}$	$9\frac{1}{2}$
	Tread ...	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$	3	$3\frac{1}{12}$	$3\frac{2}{12}$
	Seat ...	$1\frac{57}{64}$	$1\frac{66}{64}$	$1\frac{63}{64}$	$2\frac{2}{64}$	$2\frac{5}{64}$	$2\frac{8}{64}$	$2\frac{11}{64}$
E 5 Fitting	Joint ...	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$
	Instep ...	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$6\frac{3}{8}$	$9\frac{5}{8}$
	Tread ...	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$	3	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{2}{14}$
	Seat ...	$1\frac{60}{64}$	$1\frac{63}{64}$	$2\frac{2}{64}$	$2\frac{5}{64}$	$2\frac{8}{64}$	$2\frac{11}{64}$	$2\frac{14}{64}$
F 6 Fitting	Joint ...	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$
	Instep ...	$8\frac{1}{4}$	$8\frac{1}{2}$	$8\frac{3}{4}$	9	$9\frac{1}{4}$	$9\frac{1}{2}$	$9\frac{3}{4}$
	Tread ...	$2\frac{10}{12}$	$2\frac{11}{12}$	3	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$
	Seat ...	$1\frac{63}{64}$	$2\frac{2}{64}$	$2\frac{5}{64}$	$2\frac{8}{64}$	$2\frac{11}{64}$	$2\frac{14}{64}$	$2\frac{17}{64}$

CHILDREN'S and BOYS'.

Fitting	*Lengths in Sizes.*	5	6	7	8	9	10	11	12	13	1
A 1 Fitting	Joint ...	$4\frac{15}{16}$	$5\frac{2}{16}$	$5\frac{5}{16}$	$5\frac{8}{16}$	$5\frac{11}{16}$	$5\frac{7}{8}$	$6\frac{1}{8}$	$6\frac{3}{8}$	$6\frac{5}{8}$	$6\frac{7}{8}$
	Instep ...	$5\frac{5}{16}$	$5\frac{8}{16}$	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{11}{16}$	$6\frac{15}{16}$	$7\frac{3}{16}$	$7\frac{7}{16}$
	Tread ...	$1\frac{10}{12}$	$1\frac{11}{12}$	2	$2\frac{1}{12}$	$2\frac{2}{12}$	$2\frac{3}{12}$	$2\frac{4}{12}$	$2\frac{5}{12}$	$2\frac{6}{12}$	$2\frac{7}{12}$
	Seat ...	$1\frac{4}{16}$	$1\frac{5}{16}$	$1\frac{6}{16}$	$1\frac{7}{16}$	$1\frac{8}{16}$	$1\frac{9}{16}$	$1\frac{10}{16}$	$1\frac{11}{16}$	$1\frac{12}{16}$	$1\frac{13}{16}$
B 2 Fitting	Joint ...	$4\frac{3}{16}$	$5\frac{6}{16}$	$5\frac{9}{16}$	$5\frac{12}{16}$	$5\frac{15}{16}$	$6\frac{1}{8}$	$6\frac{3}{8}$	$6\frac{5}{8}$	$6\frac{7}{8}$	$7\frac{1}{8}$
	Instep ...	$5\frac{8}{16}$	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{32}$	$6\frac{27}{32}$	$7\frac{3}{32}$	$7\frac{11}{32}$	$7\frac{19}{32}$
	Tread ..	$1\frac{11}{12}$	2	$2\frac{1}{12}$	$2\frac{2}{12}$	$2\frac{3}{12}$	$2\frac{4}{12}$	$2\frac{5}{12}$	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$
	Seat ..	$1\frac{5}{16}$	$1\frac{6}{16}$	$1\frac{7}{16}$	$1\frac{8}{16}$	$1\frac{9}{16}$	$1\frac{10}{16}$	$1\frac{11}{16}$	$1\frac{12}{16}$	$1\frac{13}{16}$	$1\frac{14}{16}$
C 3 Fitting	Joint ...	$5\frac{7}{16}$	$5\frac{10}{16}$	$5\frac{13}{16}$	6	$6\frac{3}{16}$	$6\frac{3}{8}$	$6\frac{5}{8}$	$6\frac{7}{8}$	$7\frac{1}{8}$	$7\frac{3}{8}$
	Instep ...	$5\frac{11}{16}$	$5\frac{14}{16}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	7	$7\frac{4}{16}$	$7\frac{8}{16}$	$7\frac{12}{16}$
	Tread ..	2	$2\frac{1}{12}$	$2\frac{2}{12}$	$2\frac{3}{12}$	$2\frac{4}{12}$	$2\frac{5}{12}$	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$	$2\frac{9}{12}$
	Seat ...	$1\frac{6}{16}$	$1\frac{7}{16}$	$1\frac{8}{16}$	$1\frac{9}{16}$	$1\frac{10}{16}$	$1\frac{11}{16}$	$1\frac{12}{16}$	$1\frac{13}{16}$	$1\frac{14}{16}$	$1\frac{15}{16}$
D 4 Fitting	Joint ...	$5\frac{11}{16}$	$5\frac{7}{8}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{5}{8}$	$6\frac{7}{8}$	$7\frac{1}{8}$	$7\frac{3}{8}$	$7\frac{5}{8}$
	Instep ..	$5\frac{7}{8}$	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	$7\frac{4}{32}$	$7\frac{13}{32}$	$7\frac{21}{32}$	$7\frac{29}{32}$
	Tread ...	$2\frac{1}{12}$	$2\frac{2}{12}$	$2\frac{3}{12}$	$2\frac{4}{12}$	$2\frac{5}{12}$	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$
	Seat ...	$1\frac{7}{16}$	$1\frac{8}{16}$	$1\frac{9}{16}$	$1\frac{10}{16}$	$1\frac{11}{16}$	$1\frac{12}{16}$	$1\frac{13}{16}$	$1\frac{14}{16}$	$1\frac{15}{16}$	2
E 5 Fitting	Joint ...	$5\frac{15}{16}$	$6\frac{2}{16}$	$6\frac{5}{16}$	$6\frac{8}{16}$	$6\frac{11}{16}$	$6\frac{7}{8}$	$7\frac{1}{8}$	$7\frac{3}{8}$	$7\frac{5}{8}$	$7\frac{7}{8}$
	Instep ...	$6\frac{1}{16}$	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	7	$7\frac{5}{16}$	$7\frac{9}{16}$	$7\frac{13}{16}$	$8\frac{1}{16}$
	Tread ...	$2\frac{2}{12}$	$2\frac{3}{12}$	$2\frac{4}{12}$	$2\frac{5}{12}$	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$
	Seat ...	$1\frac{8}{16}$	$1\frac{9}{16}$	$1\frac{10}{16}$	$1\frac{11}{16}$	$1\frac{12}{16}$	$1\frac{13}{16}$	$1\frac{14}{16}$	$1\frac{15}{16}$	2	$2\frac{1}{16}$
F 6 Fitting	Joint ..	$6\frac{3}{16}$	$6\frac{6}{16}$	$6\frac{9}{16}$	$6\frac{12}{16}$	$6\frac{15}{16}$	$7\frac{1}{8}$	$7\frac{3}{8}$	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$
	Instep ...	$6\frac{4}{16}$	$6\frac{7}{16}$	$6\frac{10}{16}$	$6\frac{13}{16}$	7	$7\frac{7}{32}$	$7\frac{15}{32}$	$7\frac{23}{32}$	$7\frac{31}{32}$	$8\frac{7}{32}$
	Tread ...	$2\frac{3}{12}$	$2\frac{4}{12}$	$2\frac{5}{12}$	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$	3
	Seat ...	$1\frac{9}{16}$	$1\frac{10}{16}$	$1\frac{11}{16}$	$1\frac{12}{16}$	$1\frac{13}{16}$	$1\frac{14}{16}$	$1\frac{15}{16}$	2	$2\frac{1}{16}$	$2\frac{2}{16}$

YOUTHS' and MEN'S.

Fitting	*Lengths in Sizes.*	2	3	4	5	6	7	8	9	10	11	12
A 1 Fitting	Joint ...	$7\frac{1}{8}$	$7\frac{3}{8}$	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$
	Instep ...	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$	$10\frac{1}{8}$	$10\frac{3}{8}$
	Tread ...	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$	3	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$	$3\frac{5}{12}$	$3\frac{6}{12}$
	Seat ...	$1\frac{14}{16}$	$1\frac{15}{16}$	2	$2\frac{1}{16}$	$2\frac{2}{16}$	$2\frac{3}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$	$2\frac{6}{16}$	$2\frac{7}{16}$	$2\frac{8}{16}$
B 2 Fitting	Joint ...	$7\frac{3}{8}$	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$
	Instep ...	8	$8\frac{1}{4}$	$8\frac{1}{2}$	$8\frac{3}{4}$	9	$9\frac{1}{4}$	$9\frac{1}{2}$	$9\frac{3}{4}$	10	$10\frac{1}{4}$	$10\frac{1}{2}$
	Tread ...	$2\frac{9}{12}$	$2\frac{10}{12}$	$2\frac{11}{12}$	3	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$	$3\frac{5}{12}$	$3\frac{6}{12}$	$3\frac{7}{12}$
	Seat ...	$1\frac{15}{16}$	2	$2\frac{1}{16}$	$2\frac{2}{16}$	$2\frac{3}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$	$2\frac{6}{16}$	$2\frac{7}{16}$	$2\frac{8}{16}$	$2\frac{9}{16}$
C 3 Fitting	Joint ...	$7\frac{5}{8}$	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$	$10\frac{1}{8}$
	Instep ...	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$	$10\frac{1}{8}$	$10\frac{3}{8}$	$10\frac{5}{8}$
	Tread ...	$2\frac{10}{12}$	$2\frac{11}{12}$	3	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$	$3\frac{5}{12}$	$3\frac{6}{12}$	$3\frac{7}{12}$	$3\frac{8}{12}$
	Seat ...	2	$2\frac{1}{16}$	$2\frac{2}{16}$	$2\frac{3}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$	$2\frac{6}{16}$	$2\frac{7}{16}$	$2\frac{8}{16}$	$2\frac{9}{16}$	$2\frac{10}{16}$
D 4 Fitting	Joint ...	$7\frac{7}{8}$	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$	$10\frac{1}{8}$	$10\frac{3}{8}$
	Instep ...	$8\frac{2}{8}$	$8\frac{4}{8}$	$8\frac{6}{8}$	9	$9\frac{2}{8}$	$9\frac{1}{2}$	$9\frac{6}{8}$	10	$10\frac{2}{8}$	$10\frac{4}{8}$	$10\frac{6}{8}$
	Tread ..	$2\frac{11}{12}$	3	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$	$3\frac{5}{12}$	$3\frac{6}{12}$	$3\frac{7}{12}$	$3\frac{8}{12}$	$3\frac{9}{12}$
	Seat ...	$3\frac{1}{16}$	$3\frac{2}{16}$	$3\frac{3}{16}$	$3\frac{4}{16}$	$3\frac{5}{16}$	$3\frac{6}{16}$	$3\frac{7}{16}$	$3\frac{8}{16}$	$3\frac{9}{16}$	$3\frac{10}{16}$	$3\frac{11}{16}$
E 5 Fitting	Joint ...	$8\frac{1}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$	$10\frac{1}{8}$	$10\frac{3}{8}$	$10\frac{5}{8}$
	Instep ...	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$	$10\frac{1}{8}$	$10\frac{3}{8}$	$10\frac{5}{8}$	$10\frac{7}{8}$
	Tread ...	3	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$	$3\frac{5}{12}$	$3\frac{6}{12}$	$3\frac{7}{12}$	$3\frac{8}{12}$	$3\frac{9}{12}$	$3\frac{10}{12}$
	Seat ...	$2\frac{2}{16}$	$2\frac{3}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$	$2\frac{6}{16}$	$3\frac{7}{16}$	$3\frac{8}{16}$	$3\frac{9}{16}$	$3\frac{10}{16}$	$3\frac{11}{16}$	$3\frac{12}{16}$
F 6 Fitting	Joint ...	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$9\frac{3}{8}$	$9\frac{5}{8}$	$9\frac{7}{8}$	$10\frac{1}{8}$	$10\frac{3}{8}$	$10\frac{5}{8}$	$10\frac{7}{8}$
	Instep ...	$8\frac{4}{8}$	$8\frac{6}{8}$	9	$9\frac{2}{8}$	$9\frac{4}{8}$	$9\frac{3}{4}$	10	$10\frac{2}{8}$	$10\frac{4}{8}$	$10\frac{6}{8}$	11
	Tread ..	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$	$3\frac{5}{12}$	$3\frac{6}{12}$	$3\frac{7}{12}$	$3\frac{8}{12}$	$3\frac{9}{12}$	$3\frac{10}{12}$	$3\frac{11}{12}$
	Seat ...	$2\frac{3}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$	$2\frac{6}{16}$	$2\frac{7}{16}$	$2\frac{8}{16}$	$2\frac{9}{16}$	$2\frac{10}{16}$	$2\frac{11}{16}$	$2\frac{12}{16}$	$2\frac{13}{16}$

CHAPTER IV. SCALE 5.

Difference between Fittings.

	0 to 10	11 to 1	2 to 12
Joint.	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Instep.	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{8}$
Tread.	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$
Seat.	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$

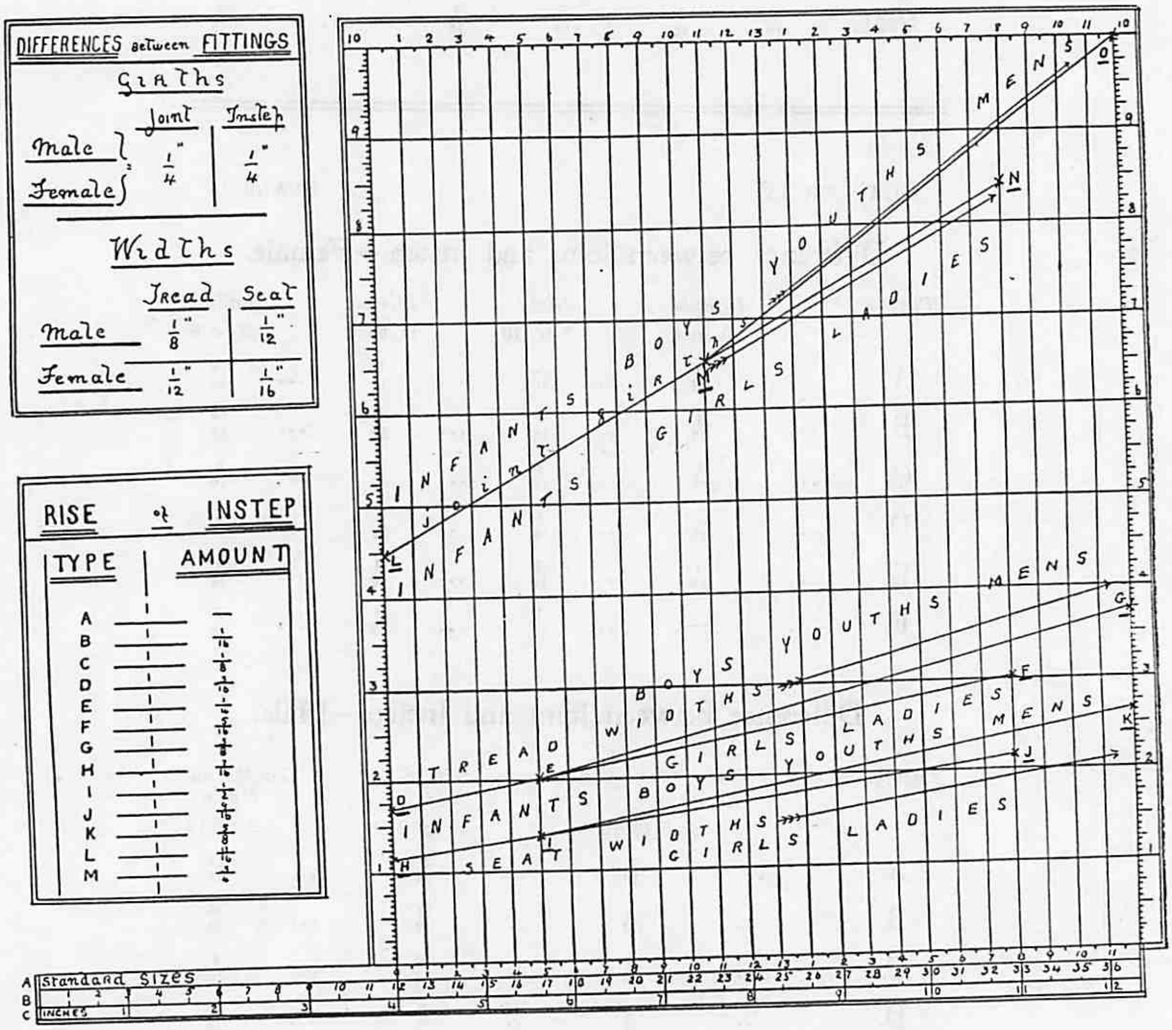
CHAPTER IV. SCALE 6.

Difference between Joint and Instep—Female.

Fitting.	*Infants'.* 0 to 4	*Girls'.* 5 to 10	*Misses'.* 11 to 1	*Ladies'.* 2 to 8
A.	$\frac{5}{16}$	$\frac{6}{16}$	$\frac{9}{16}$	$\frac{12}{16}$
B.	$\frac{4}{16}$	$\frac{5}{16}$	$\frac{15}{32}$	$\frac{10}{16}$
C.	$\frac{3}{16}$	$\frac{4}{16}$	$\frac{12}{32}$	$\frac{8}{16}$
D.	$\frac{2}{16}$	$\frac{3}{16}$	$\frac{9}{32}$	$\frac{6}{16}$
E.	$\frac{1}{16}$	$\frac{2}{16}$	$\frac{3}{16}$	$\frac{4}{16}$
F.	—	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{2}{16}$

Difference between Joint and Instep.—Male.

Fitting.	*Children's.* 5 to 10	*Boys'.* 11 to 1	*Youths' and Men's.* 2 to 12
A.	$\frac{6}{16}$	$\frac{9}{16}$	$\frac{12}{16}$
B.	$\frac{5}{16}$	$\frac{15}{32}$	$\frac{10}{16}$
C.	$\frac{4}{16}$	$\frac{12}{32}$	$\frac{8}{16}$
D.	$\frac{3}{16}$	$\frac{9}{32}$	$\frac{6}{16}$
E.	$\frac{2}{16}$	$\frac{3}{16}$	$\frac{4}{16}$
F.	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{2}{16}$



Determination of Grades of Lasts.

produces the small sizes very much larger in girth than they would be if the grade was run down continuously.

A set of lasts should be all sizes between 0's infants' and the largest size in ladies' or men's; but owing to the difficulty in the grading, they are sometimes divided into different sets, and referred to as infants' sizes—0's to 6's; childrens' sizes—7's to 1's; ladies' sizes—2's to 7's; youths' sizes—2's to 5's; men's sizes—6's to 11's.

Each of these divisions may be graded from a centre size, and a quarter-of-an-inch difference in girths adhered to without much practical harm. Some last makers grade the children's joints three-sixteenths between size and size. This latter method of grading, in conjunction with the quarter-inch grade for adults, produces a very good working system. The male sizes are graded down from men's 11's to boys' 11's, by the quarter-of-an-inch grade, below that size the joints are graded by differences of three-sixteenths. The female sizes are graded down from ladies' 7's to ladies' 2's in the quarter grade, below size 2's they are graded by three-sixteenths; this produces the same girth at size 5's for both boys' and girls', which is a very practical way. The joint widths are graded by twelfths-of-an-inch for males, and sixteenths-of-an-inch for female sizes. Starting from size 5's, children's, at two inches across the tread; this produces the standard width of tread of both men's and ladies' in the adult sizes.

It is recognised that the manner in which we number our sizes is not correct. It would be much preferable if the numeration began at the beginning of the stick and was carried regularly to the larger sizes. A comparison between the present method, the improved method and the standard inch is shewn upon Plate 15. A represents the usual sizes; B the proposed method of numbering them; C a standard inch. If the new method was adopted, the present size 0's would be size 12's; the present size 12's would be size 24's; the present size 5's, ladies' would be size 30; the present size 8's, men's, would be size 33. The alteration in the numbers of the sizes can be traced upon the scale. The girth and width grades may be determined geometrically either in a straight line and regular grade by two or more straight lines meeting, or by a curve.

The method of determining the actual dimensions would be to select the measurement required for some particular size—we will assume size 8's—determine the measurements required for some much smaller size, and divide the difference between. The scale explains the method of doing this. Lines are drawn at right angles to each one of the sizes of sufficient length to take the dimensions, as 1, 2, 3, 4, etc. Measures are taken up the lines—we will assume at size 8's—marking off the amount required for the joint, tread and seat. Measurements are then taken—we will assume at size 5's, infants'—and corresponding points marked as before. These lines being connected, the vertical lines of the scale are divided in such a manner that the amount measured from the base line to the point of division is the dimension required. In the scale given, the point D at 1-inch-and-11/16ths, representing the width of the tread for 0's infants', is connected with the point E at size 5's, making a difference between size and size of one-sixteenth-of-an-inch. At size 8's, ladies', a point three-inches from the base marked off F E is connected to F, grading the whole of the sizes by one-sixteenth-of-an-inch. Size 8's, men's, has 3-inches-and-1/3rd marked off.

The line from E being carried from this point to G grades the whole of the sizes from 5's children's to 11's men's by one-twelfth of an inch. A similar method is adopted with the seats,

point H is connected with the point I for infants', the point I to the points J and K for ladies' and men's grades respectively. For joint girths the first grade would be from infants' 0's to size 11's, as L M. From M towards the ladies' grade N and the gents.' grade O any difference that may be required or any dimensions that may be wished for may be determined by the straight line MN, MO. This is placing the matter in its simplest form. If three points were taken, a small, intermediate, and a large size, and the grade was not continuous, the result would be a curve or a series of straight lines ; this determines the dimensions for one fitting, but without reference to the rise of instep. The difference between fittings are shewn upon the small scale. The rise of insteps would vary with the class of work and the size of the last. It would probably be better to divide these into types, as shewn.

Seeing that the difference between the joint and the instep is very small in some classes of last, and that there should be a smaller difference in the small sizes than in the larger, it is somewhat difficult to select a fraction that will make the differences required, and which can be determined by an ordinary tape. Assuming that one-sixteenth is a practical difference, and that lasts may be divided into three sections—childrens', youths,' and adults', then there would be a decrease in the rise of instep of one-sixteenth for each type in each division. If the last of the adults' size was type F, with a two-sixteenths rise, then the boys' would have three-thirty-seconds rise, and the children's one-sixteenth.

The scale in the actual figures that includes the measurements thus given is commonly used by United States and British last makers. The substance of it was originally issued by The United States Retail Boot and Shoe Dealers' National Association, and produced by The Shoe and Leather Reporter (see scale).

The original scale which formed the basis upon which this has been arranged, has joint girths an eighth-of-an-inch less than given here. This extra eighth appears to be an advantage for most classes of work. The half sizes and half fittings can be found by finding the measure between the next sizes or fittings to that required.

These measurements include the standard measurements for lasts of each size. Therefore, any particular size required may be picked out from the scale.

There is a considerable difference required in the type of the last and in the fitting for different districts and different classes of work. It may be assumed that with an increase in the substance of the work there is a corresponding increase in the fitting required for the same person, *i.e.*, a very light boot would have a smaller girth measurement than a stout boot in the same fitting. Fitting E for light work would be one fitting less in its dimensions than the same fitting in the next heavier substance of work, and so on through the different weights.

The differences of climate also influence the dimensions of the fitting. In temperate climates we use the narrowest fittings. In very hot and very cold climates wider fittings are required. For instance, a C or 3 fitting for London or Boston would be a B fitting in Scotland or New Orleans.

In colonial countries a wider fitting is generally required, but the sizes are generally smaller in length. For instance, in New Zealand the majority of people appear to have short, thick feet. In South Africa the fittings are also wide. In Australia the fittings are about the same as London or

New York. In Cairo and in India a comparatively narrow fitting is commonly used. Upon the European Continent the majority of people appear to take rather wider fittings than English-speaking people. A comparison between the dimensions of English and Continental lasts shew that our average fittings are one fitting smaller than those used on the Continent. A size 8's men's joint 3's fitting should measure 9-inches-and-one-eighth. Size 42, the corresponding length in French sizes, has a joint measuring $23\frac{1}{2}$ centimetres, which is equivalent to 9-inches-and-three-eighths. The rise of instep on the Continental lasts is a centimetre (2/5ths-of-an-inch), which would make the last about equivalent to our D (4) fitting. The other measurements are all about the same proportion and may easily be ascertained by making allowances from the standard measurements given.

STANDARD MEASUREMENTS.

Using Paris points for sizes, and divisions of the centimetre for differences in girths and widths.

Infants', 3's fitting.—Size 19, Paris points; nearly size 3, English.

Joint.	*Instep.*	*Tread.*	*Seat.*
12	$12\frac{1}{2}$	$4\frac{1}{3}$	$2\frac{7}{8}$

Children's, 3's fitting.—Size 28, Paris points; nearly size 10, English.

Joint.	*Instep.*	*Tread.*	*Seat.*
16	17	6	$4\frac{2}{3}$

Boys', 3's fitting.—Size 33, Paris points; nearly size 1, English.

Joint.	*Instep.*	*Tread.*	*Seat.*
$18\frac{1}{2}$	$19\frac{1}{2}$	$6\frac{5}{6}$	5

Ladies', 3's fitting.—Size 37, Paris points; nearly size 4, English.

Joint.	*Instep.*	*Tread.*	*Seat.*
21	$22\frac{1}{2}$	$6\frac{5}{6}$	$4\frac{7}{8}$

Men's, 3's fitting.—Size 42, Paris points; nearly size 8, English.

Joint.	*Instep.*	*Tread.*	*Seat.*
$23\frac{1}{2}$	$24\frac{1}{2}$	8	$6\frac{1}{8}$

Differences between Sizes and Fittings.

Joint.	*Instep.*	*Tread.*	*Seat.*
$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{8}$

The scales given above represent the centre sizes in sets, with the equivalent lengths in English sizes. The other sizes and fittings can be found by adding or deducting the differences given.

The South American trade appears to require two distinct types of lasts: the ordinary European last, and a special last with extra high instep and with very great spring at the toe. The toe spring of these lasts are sometimes as much as one-and-three-quarter inches. French sizes and centimetres are the standards of measurements for South America, the dimensions being very similar to Continental dimensions, with the exception of the Creole lasts, which have a rise of instep of about three-quarters-of-an-inch. These lasts are proportionately very narrow in the bottom, generally about two fittings narrower than ordinary, the amount deducted from the bottom being put on the top of the last.

Many attempts have been made to apply practical geometry to the determination of last grades, but without much success, owing to the fact that last makers are very seldom acquainted with the science. An extension of the principle shewn on Plate 15 is also shewn upon Plate 16.

Mr. Alden, of Norwich, originated a principle that the difference between lasts should be proportionate to their length. The application of this principle would entail the use of fractions so minute as to make their use practically impossible. The dimensions might, however, be read off special tapes as he suggested, or off a scale as shewn here.

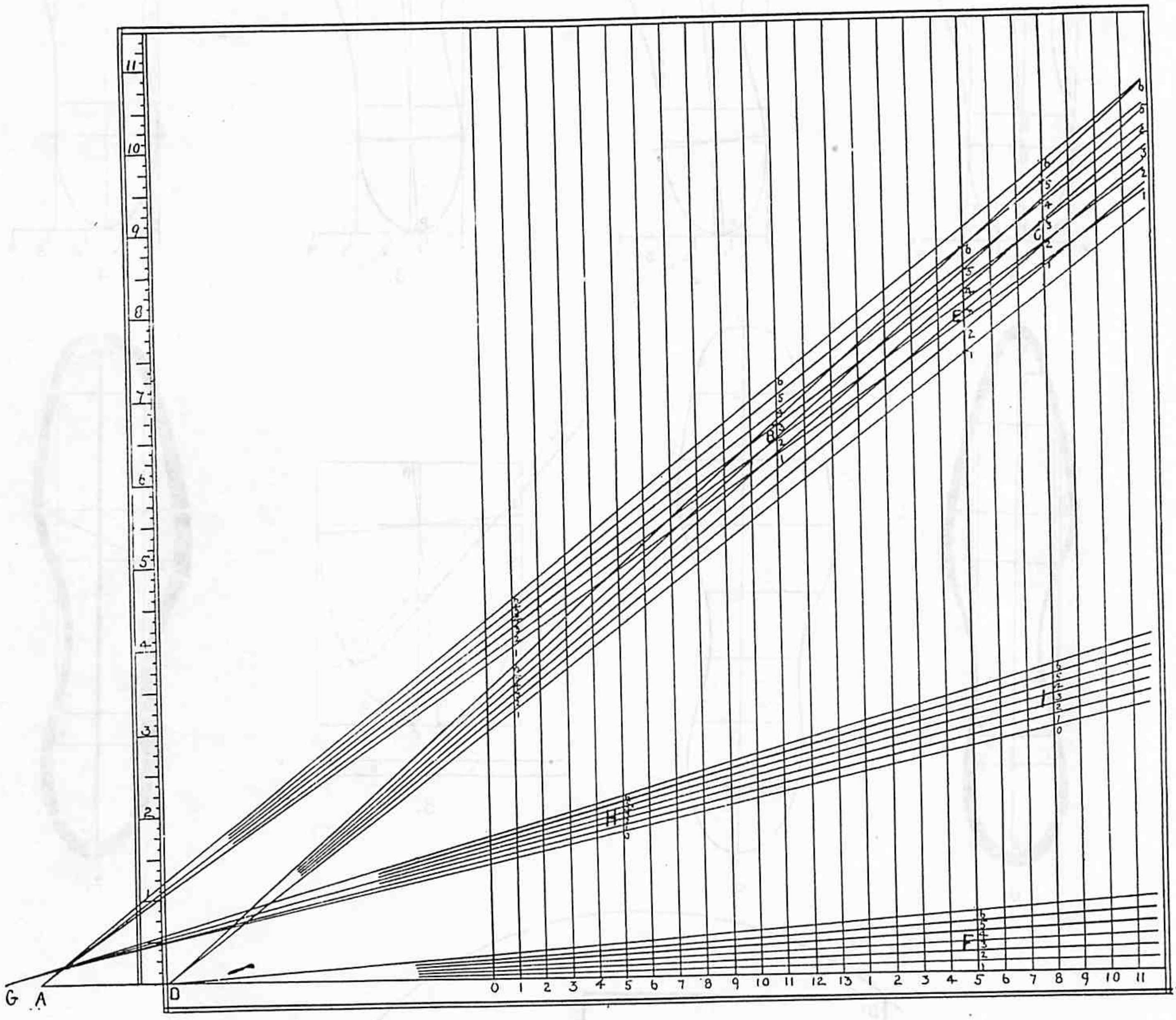
Assuming the line A to represent the length of lasts, the vertical lines might be used to reg' ,ter their girth. If we first mark off the dimensions of the 3's fitting, in two sizes—one twice the length in inches than the other—as size 1 and size 11's, children's, and then connect them by a straight line, produced both ways as the line B A, where the line touches the point A would be the radial point for grading all those fittings. If at the point B the difference between the fittings required is first marked as points 1, 2, 3, 4, 5, 6, and lines drawn from A through each one of those points, it will grade the proportional difference between the fittings for all sizes, as B C. The radial point A might come anywhere in the direction of the line A B. If the difference was required in proportion to the length, it should first be marked off as E F for a standard size—say size 5's; the points found would be connected to the commencement of the line length, as point D. These lines would grade the whole of the differences in proportion to the lengths.

If the differences were required in proportion to girths or widths, or to any arbitary difference, the amounts should be marked off at two points, as H I. These being continued, would all coincide at one point, as G.

This is placed before the student for the purpose of experiment, if he studies the principal of the diagram he will be able to make applications for himself, as the principle can be applied to the solving of any problem connected with proportionate dimensions.

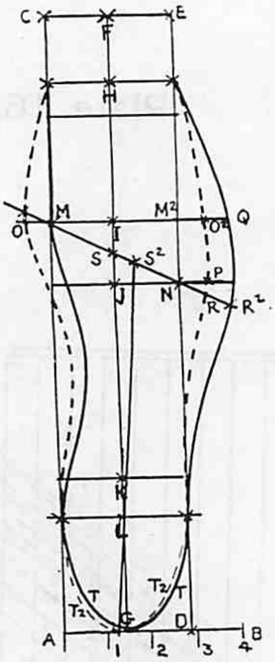
To face Page 38.

Plate 16.



Determination of Grades of Lasts.

Plate 17.



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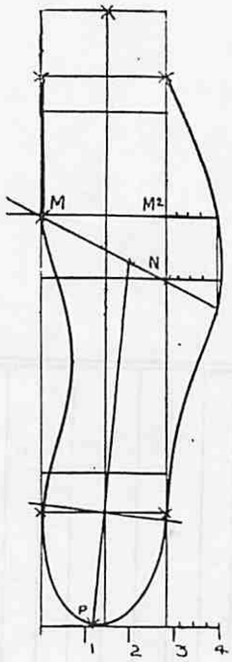

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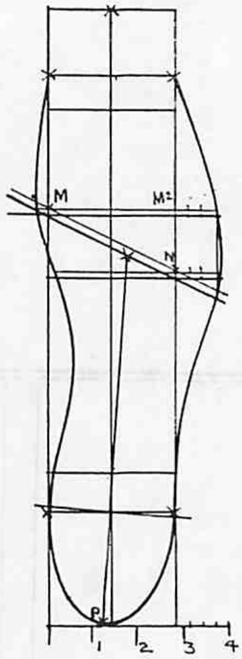

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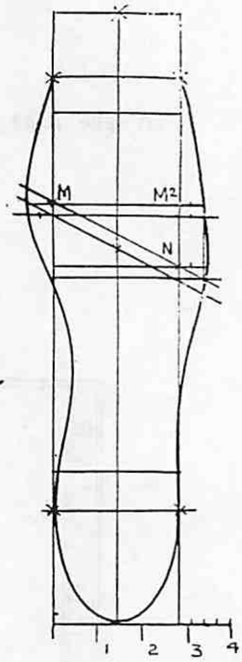

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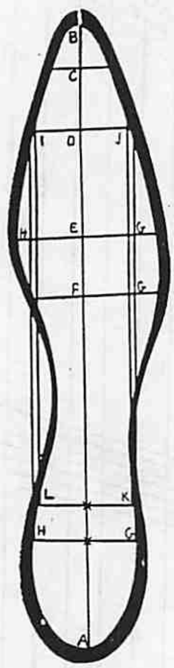

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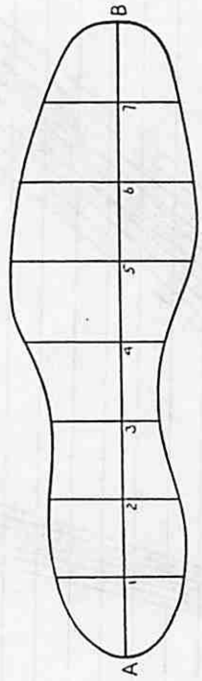

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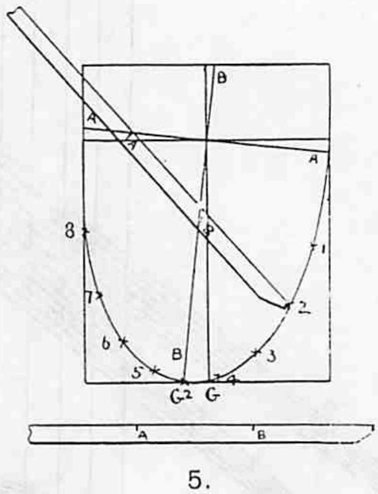

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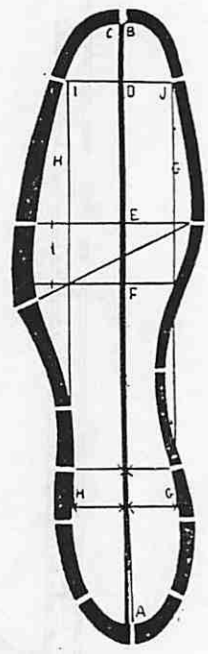

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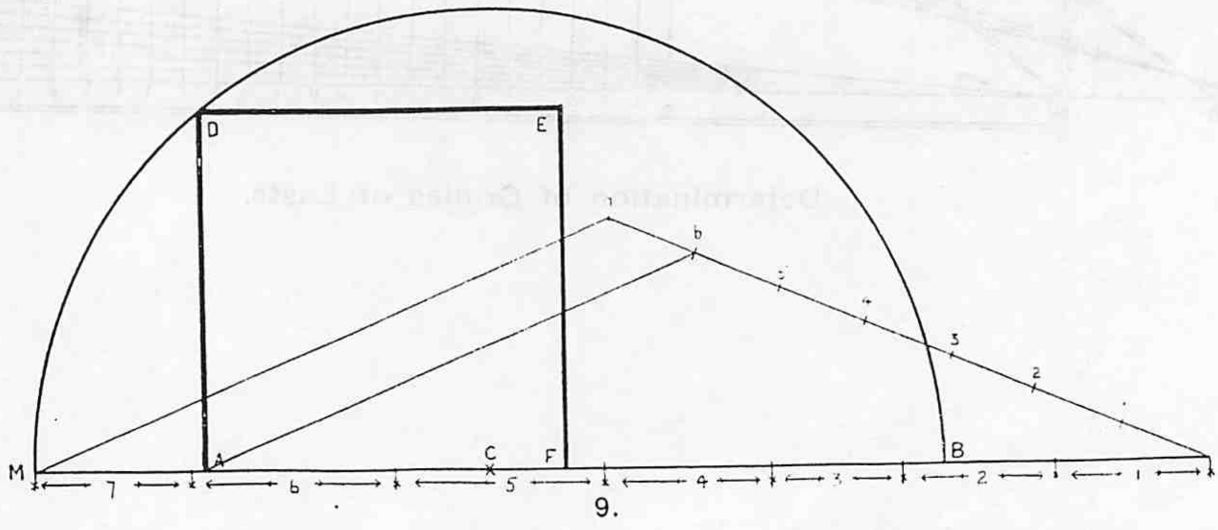

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CHAPTER V.

Pattern Designing, Grading, and Making.

THE designing of the various parts of footwear is usually referred to as pattern-cutting, probably because the design is generally cut out in paper. Grading is the production of a number of sizes from the specimen pattern ; if the number graded include the sizes commonly grouped as a set in last making, they represent a " set " of patterns. Generally a set consists of six sizes of one style and one fitting.

The production of working patterns in millboard, zinc, sheet iron, or steel, is called pattern-making. It is a far more mechanical process than pattern-cutting, in fact does not vary much from the making of patterns for other clothing trades.

The ideal pattern-cutter is a scientific artist. The condition under which he produces his designs makes it indispensable that he be accustomed to great precision in measurement ; that he make provision for the alteration in shape and dimensions of the materials that his designs are produced in ; and certainly not least, that he produces footwear that are artistic in shape. He therefore has to be scientific in his calculation, and artistic in his method of providing for them.

The art of the pattern-cutter is seen at its highest in the designing of sole shapes. The curves are so delicate and so complicated, that although rules may be laid down and certain points must be worked to, the actual shaping depends largely on the individual skill of the workman.

The usual construction lines are shewn upon Plate 17. Figure 1 represents the basis of the method by which the different styles are cut. Mention has been made before of the range and slope of the foot, and of the last. The student is expected to know the meaning of these terms.

The line A B, Figure 1, represents the width of the tread. This should be divided into four parts, as 1, 2, 3, 4. A point D should be made one-eighth-of-an-inch from the third division. From the point A at right angles to A B, draw a line A C, making it equal the desired length of the sole shape. If it is intended that the sole shall be longer than the standard length, an additional amount should be left on beyond C. Draw D E paralleled to A C. Bisect the oblong A C D E by the line F G. At 1/10th of the length of the shape from F draw the line H. At 1/3rd of the length of the shape from F make the line I. At 1/10th of the length of the shape from I make the line J. At 1/4th of the length of the shape from G draw the line K. At 3/4ths of G K draw the line L. All these cross lines are at right angles to the line A C. The width of the line A D, C E, is the standard width of the seat and the standard width of the toe, at the distance F H. The difference between the width of the tread and the width of the seat may be left upon either side of the lines A C, E D ; but the character of the shape will depend upon the amount left at the inside joint M or the outside joint N. The line M N passes through the inner and outer joints. The width of the shape should be preserved across M M2. It may be equally divided as M O, M2 O2 ; the amount between M2 O2 being left on at N P ; this will

produce a straight form as the dotted line. This shape is referred to as the Camper form. It is the straightest form in a rights and lefts sole shape ; the amount upon the inner side MO being equal to the amount on the outer side M2 02, NP. The other extreme to this is seen in the solid line in which the whole of the difference between the tread and the seat is left on at Q R2 ; this produces a straight inside edge from M forward. In both cases the sides of the toes are brought to the points, as shewn. The actual shape of the end of the toe is left to the taste of the designer. The line M N R, naturally carries the curvature forward at the inside joint, and back at the outside joint ; this is correct, the point M representing the position of the longest joint measure from the toe. As the shape becomes straighter this line naturally carries the contact point further forward, so that at O, it is in front of M. The reverse to that occurs at the outside joint, where the distance between the line N P is greater at R2 than at R. Therefore, the more twisted the form the longer the outside joint. This exceedingly twisted form, with all the difference upon the outer side, is called a Meyer form. The amount which the joint curves stand proportionately on either side of the lines A C E D, determine the range. The Camper shape is a straight range. The Meyer form a twisted range.

As the width of the forepart moves across the shape, the range of the seat naturally turns with it. The amount which it turns is shewn by the point S S2 ; each of these points bisect the line MN. S bisects O M, N R ; S2 bisects R2. Therefore, in all cases, having decided the type of sole shape, the seat is produced symmetrically about the line S2 L. The curve of the seat for a straight form is shewn at TT. That for a twisted form at T T2. These curves are produced as shewn in Diagram 5. The line SG is represented by the line BG or B G2. A slip of paper as shewn has half of the width of the seat marked upon it as B, and the distance GL as A. Mark the cross line at LA ; mark the length line B ; place this strip so that the points marked are upon the lines as the Diagram ; move it round in various positions, keeping the points on the lines and mark where the taper end of the slip comes to, as 1, 2, 3, 4. The paper being moved to the other side and the operation being repeated, points may be marked as 5, 6, 7, 8.

The operations used in producing the different classes of sole shapes are shewn separately in Figures 2, 3 and 4. Figure 2 represents the production of a Meyer form. The distance between the width of the seat 3 to 4 is divided into four parts ; in this case the whole of it is left upon the outside joint, as at M2 N. Draw MN, making the distance between the lines E D and the end of the line MN, equal to the difference between the tread and the seat as shewn. The curve of the outside joint will sweep out between the two points; the width measurement being taken at M M2. The line from the point P with the construction of the seat has been explained, having marked out the seat, cut through the points found to the toe, as diagram, and complete the shape. Figure 3 represents a medium form, suitable for a boot with a heel about one inch high. The line MN is moved forward one-twelfth-of-an-inch ; quarter of the distance 3, 4, is marked upon the inner side M, the remainder upon the outer side M2 N. The seat is shaped exactly as previously described, and the curves completed as in other sole shapes. Figure 4 represents the extremely straight range. The lines M N are moved forward two-twelfths-of-an-inch ; the shape is suitable for shoes with one-and-a-half to two inches ; the amount allowed on the inner side M, is half the difference between tread and seat, the other half being allowed upon the outer side. The other construction lines are precisely the same as for the other shapes, but as the line MN has its centre exactly in the centre of the shape, the seat points straight forward.

Mention has been made that a shape may be carried beyond the normal length of the last ; this is illustrated at Figure 6. AC represents the standard length of a shape ; BC, an extra amount

left on the end of the toe for the purpose of securing a smarter appearance. Where an extremely smart toe is wanted, the curves at the side of the shape may be brought into I J, which are taken from the corners of the seat K L; the other construction lines and proportions being the same as before. This shape also shews the method of leaving on the difference between the inner and the outer sole. Round the seat A G, A H, an allowance is required for the upper and the stiffener; beyond these points it is usual to cut the waist rather closer. The amount left on the forepart must provide for the substance of the upper, and for anything that is inserted in it, as the toe box and the side linings; after those are provided for, the width of the welt required must be added on. This results in a general comparative difference between the inner and the outer sole, as Figure 6. Figure 7 represents the practical method of getting the results. In this case it has been assumed that an irregular amount has been required to be left on the sole. The lines should be drawn as shewn normal to the curves of the inner sole, and the actual amounts required at each part measured off. It is found that in most cases some extra allowance is required on the outside joint, particularly in Men's work. The illustration represents an extra wide outside feather, with an accentuated outside corner to the tread.

The usual amounts required for the substance of the upper for ladies' light work is one-sixteenth-of-an-inch round the forepart, one-twelfth-of-an-inch at the toe, and one-sixth-of-an-inch round the seat. In addition to this, an allowance must be made for the width of welt and the making of the seat. Medium substance work requires an extra thirty-second, stout work an extra one-sixteenth.

Men's light work requires an eighth-of-an-inch round the forepart, one-sixth-of-an-inch at the toe end, and a quarter-of-an-inch round the seat, with extra allowances as described for the ladies'. A close welt is generally provided for by an allowance of one-eighth-of-an-inch; a medium welt, by three-sixteenths-of-an-inch; a half-wide welt, by a quarter-of-an-inch; a full half-wide, by five-sixteenths-of-an-inch; a medium-wide, by three-eighths-of-an-inch; a full wide, by half-an-inch, in addition to their allowances for upper. The seats require, for close seats, eighth-of-an-inch; full seats on stout work, three-sixteenths-of-an-inch; German seats, quarter-of-an-inch, in addition to the allowance for upper and stiffening.

A method of determining the surface measurement of a sole shape is shewn at Figures 8 and 9. Draw the line A B down the centre of the shape, divide it into regular divisions, as 1, 2, 3, 4, 5, 6, 7; add the length of these lines 1 to 7 together, by placing a piece of paper or a string along each line one after the other; divide the length found by the number of the cross lines. We will suppose that the line A B measures 10 inches, which is a size 5's sole shape, and that the whole of the cross lines added together measure 21 inches. If the 21 is divided by 7 we have 3 inches, multiply the length 10 inches by the average width 3 inches, which equals 30 inches, *i.e.*, nearly the number of inches that there is in the sole shape. This may also be found out geometrically by drawing a line as M, marking along it one after the other the length of the cross lines, as 1 and 2 and 3, and so on; draw a line from one end at any angle and divide it off into regular spaces, say half-inches, as 1, 2, 3, 4, 5, 6, 7; join 7 to M; from 6 draw a line parallel to 7 M, where it meets the line at the point A is the average of the cross lines; from A mark A B—the length of the sole shape; divide M B into two parts as C, make the semi-circle B M; make the upright line A D meeting the semi-circle; this line A D is the side of a square that represents the surface contained in the sole shape, as A D E F. A rectangle representing the shape would be made up of the line M B in length by a width equal to A M.

Sole shapes are now generally graded by machine, and very beautiful results obtained—see "Hartford Grader"; but the exercise of sole grading by hand is so valuable as a training to students that a description of the method is added here.

The simplest example of grading can be illustrated by the production of a set of sole shapes. By a set we mean the whole of the sizes in some division, or a complete range of sizes from infants' to adults'. These may include two distinct methods of grading. The production of a few sizes may be made by systems that are practically correct, although they produce minute deviations from actual correct measurements. In a long range of sizes the precise measurement must be kept; thus sometimes requiring a modification of a system. In all cases, in addition to the measurements required, we must keep the correct curve of the original standard. Where we have to grade to fixed measurements that are not in geometrical proportion, it is very difficult to keep the curves all alike, because similar curves are developed in arithmetical and geometrical proportion. The most popular method of grading or producing sets of patterns is what is termed the "Radial system," which is simply a practical method of producing a proportional curve. The tool commonly used is shewn at Figure 1, Plate 18. A line AB is drawn the length of the pattern to be graded into a set. The difference required between each pattern in length is marked up the line BC taken at right angles to AB, as 1, 2, 3, 4, 5, 6. These may be marked off in any difference that is required—English sizes, half-sizes, or divisions of the centimetres.

The student should carefully examine this tool, as it contains the essential principles by modifications of which any grade can be secured. Seeing that the largest amount of difference in the width of the lines is across BC, other differences in the width of the lines will be in proportion to their distance from the point A. If the differences across BC were 1/3rd-of-an-inch, then at half the difference between A and B the difference across the lines would be 1/6th-of-an-inch—half BC. At a quarter of the distance from A to B the difference would be a quarter of the differences across BC—this would be 1/12th-of-an-inch. The same principle applies to any of the other differences. At 3/4ths of the distance from A to B the spaces across would be a quarter-of-an-inch, because that is three-quarters-of-a-third. It must therefore be apparent that the differences between the spaces across the tool is in proportion to its distance from A and the differences across BC. Figure 2 shews the method of using the "Radial system." The sole shape is drawn out as shewn, and a point marked in the centre of the tread as point C. Grading points are marked round the edge of the sole shape in the centre of each curve. The numbers shewn in this diagram are about sufficient for most sole shapes, and are in the position most usually convenient. Seeing that the distance from A to B in the tool (Figure 1) determines the distance across it, it must be evident that if you put the point A, Figure 1, upon the point C, Figure 2, with the line AB against any one of the lines from the centre C, that where the outline of a sole shape met the line AB on the tool would indicate the proportion that should be allowed at that part. It must also be evident that as we move the tool round from line to line that we should get different amounts, because the distance from C to the outline is different at each point. Seeing that the tool is made the length of the sole shape, and that sole shapes of the same length have various widths according to the fitting, the difference made across the shape would vary with its width, and that by this system without modifications, differences would occur in the grades according to the width of the original standard.

This would not affect the difference between size and size in length, neither does the position of the point C affect the amount of difference left on. Figure 3 shews the method of applying the

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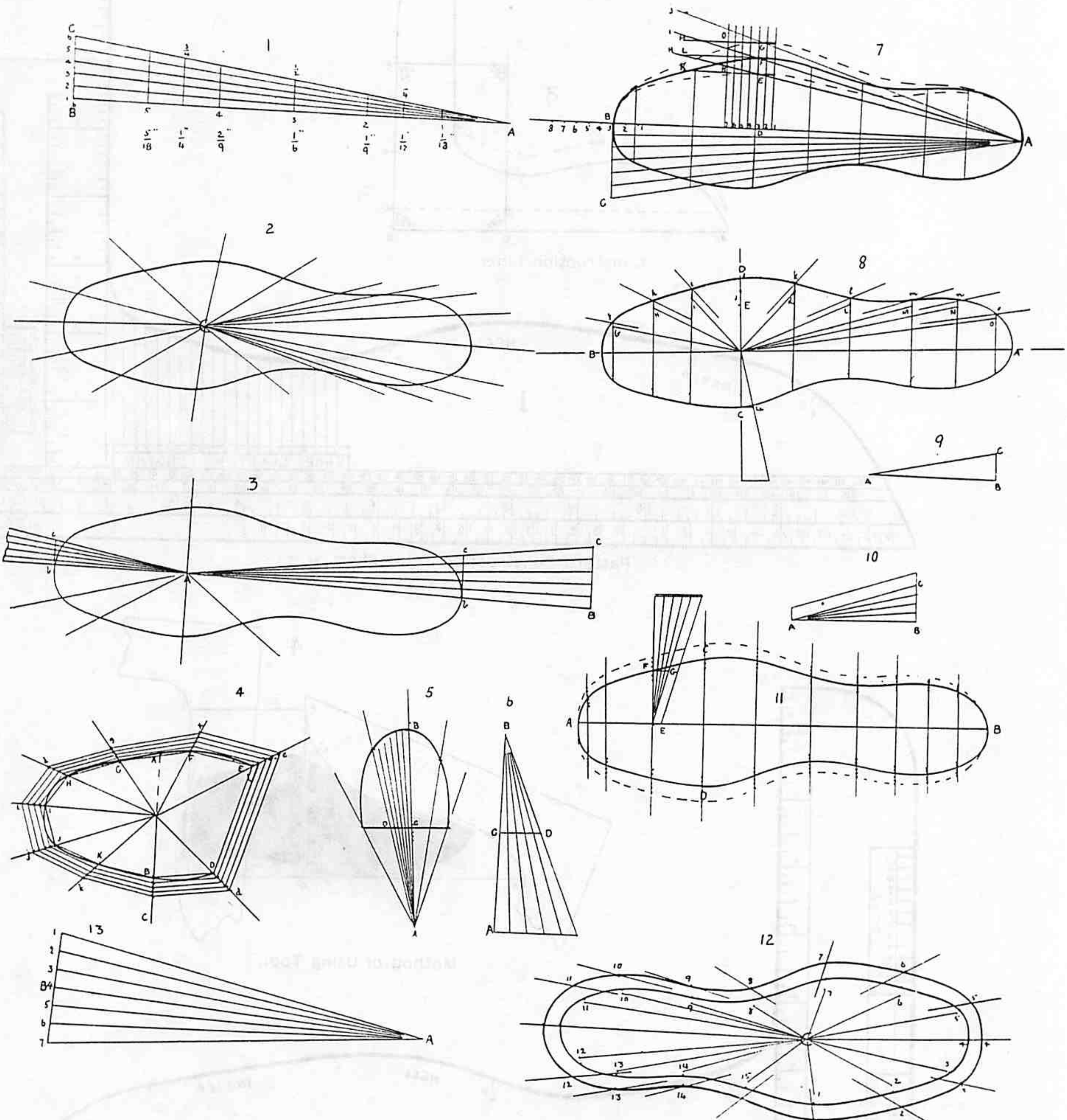
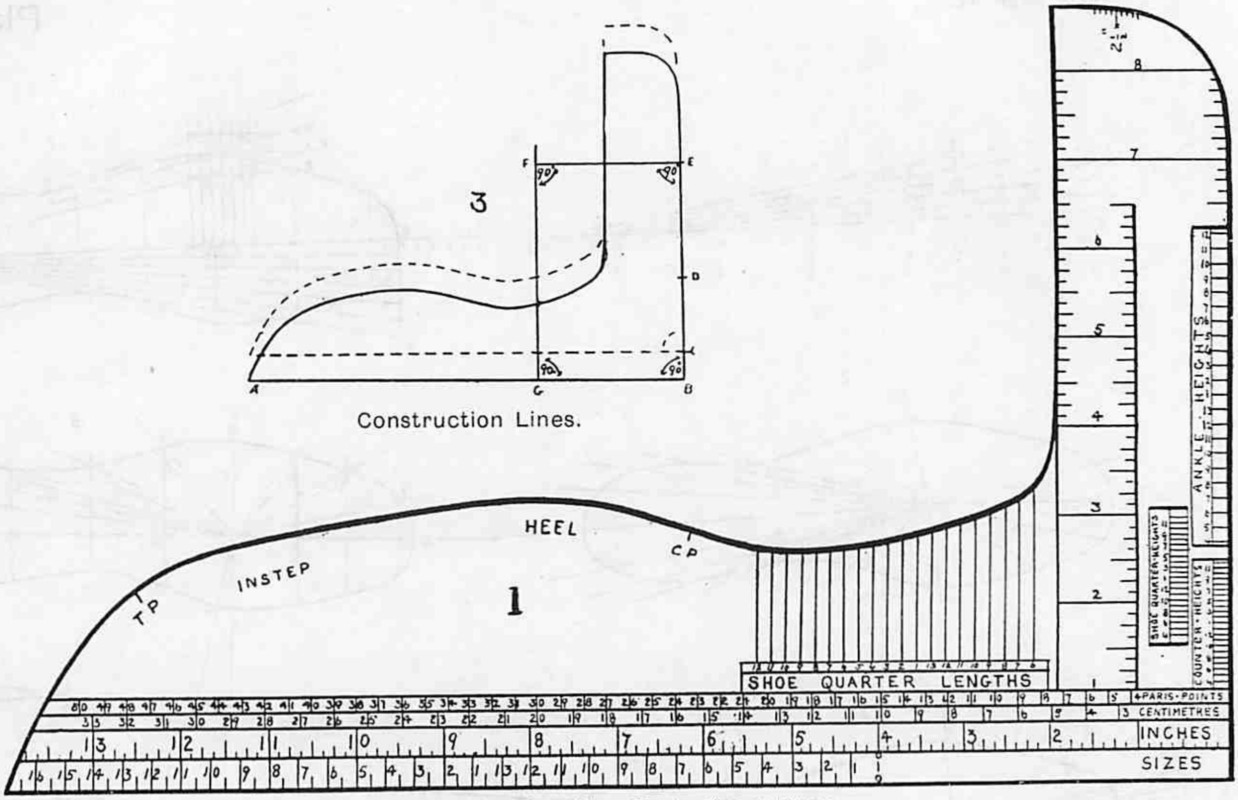
Plate 18.

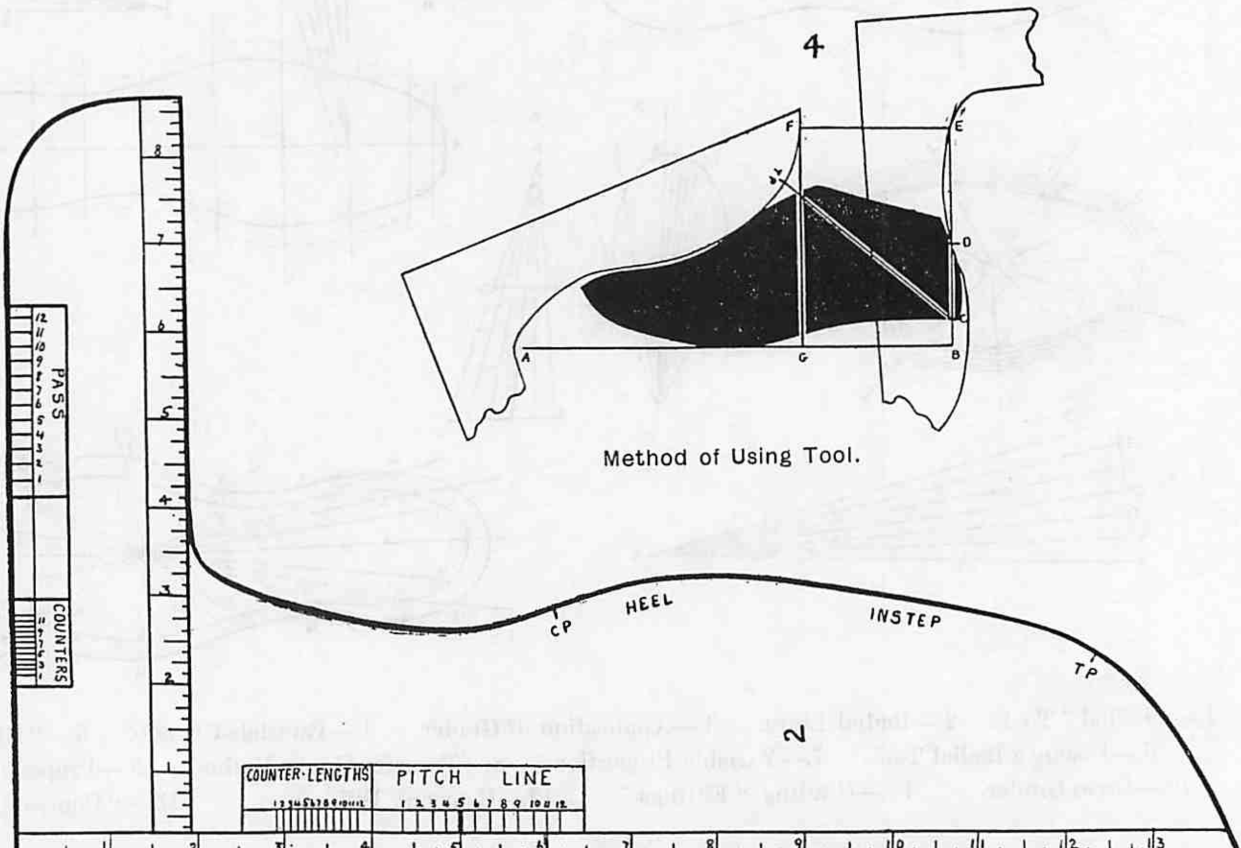


1.—"Radial" Tool. 2.—Radial Lines. 3.—Application of Grader. 4.—Paralleled Grade. 5.—"Distance" Centre. 6.—Distance Radial Tool. 7.—Variable Proportion. 8.—Transfer Grade Method. 9.—Proportionate Tool. 10.—Cross Grader. 11.—Grading "Fittings." 12.—Constant Differences. 13.—"Comparative" Grader.



Construction Lines.

Pattern Construction Tool—Short Work.



Method of Using Tool.

Pattern Construction Tool—Long Work.

tool. Several lines have been left out for the purpose of simplifying the diagram. The centre point is made in the centre of the tread, as before. The tool with the point A on the centre is represented as having the line AB passing through the back of the heel; where it crosses the outline of the sole shape is the point where the difference is required to be left. The line across BC shews the actual amounts. The distance AB is the proportionate distance for that line length of the shape. The remainder of the total grade would be left on at the toe. This would occur automatically when the tool was turned with the line AB passing through the toe. The actual method of making the grade is as follows :—

The standard from which it is required to produce the set is marked out with a very fine lead pencil, or preferably, a dull awl, on a piece of cartridge paper, the radial lines are then drawn as Figure 2. A line is drawn on a piece of thin, tough paper, the length of the sole shape, as AB, Figure 1. BC is drawn at right angles to AB. Up BC, mark the differences required in length, as many points as you require to grade sizes; from each one of these points draw a line down to point A—this produces the radial tool. To apply for grading purposes place it face down upon the outline of the sole shape, with the point A on the radial centre, and the line AB exactly along one of the radial lines. Where the tool crosses the outline, fold the tool back on itself so that the point B comes down on the line AB. The differences across BC will then be on the folded edge; turn this folded edge against the line previously used, so that the centre point is exactly on the outline of the shape; prick off each of the points as they lay along the line, you will then have a number of points representing the amounts to be left on or taken off at the point graded; repeat this at each of the lines coming from the centre, this will produce what is called a "radial stencil"—a piece of paper with a number of holes in it that represent the differences in the grade required in the set of patterns being produced. Figure 4 represents the application of this to a set of clump patterns. The points for any particular size are pricked through on to another piece of paper, and then connected by laying the original standard pattern against the corresponding points on the paper.

In hand grading operations it is advisable to start from the toe ends. Having pricked the next size to the standard size through on a piece of paper, and having marked the exact position where the radial lines cross the outline of the standard pattern, place the centre of the toe of the standard against the hole representing the centre of the toe of the pattern to be graded. Have the centre of the heel of the standard pointing directly towards the hole representing the heel of the pattern to be graded, and make a cut straight across the toe about eighth-of-an-inch each side of the centre hole. Now shift the standard pattern until the hole at the corner of the toe is against the corresponding hole to be graded; turn the point at the centre of the toe until the curve of the toe connects the corner to the centre: cut between these two points. Now keeping the corner of the toe in its place, turn down the side of the sole shape until you connect the next point: cut between these two points—that is, from the corner of the toe down to the next point at the side; that is the special method required for grading the corners of toes or a very, very sharp curve. The point to be graded to, or from, should be focused, and the curves towards it made by simply turning the standard until it connects the the nearest point to the centre of the sharp curve. All other curves are graded in a rather different manner. The object is to extend or shorten the curve in each part of the shape: this is done by arranging the original standard so that the holes are equal in distance on each side of the same part of the standard.

In the grading of the sole shape we are describing, we should now put the joint line against the two next holes, so that the marks on the standard were both equal distances from the two holes.

In a large size the two holes would be on the outer side of the marks on the standard. In grading smaller sizes the holes would be on the inner side of the marks on the standard. In either case a cut would be made along the edge of the standard connecting the two holes: this would be repeated between each of the holes right round the shape, until we come to the toe on the other side and produce the fresh size. The size cut would be used in grading the next size; the awl holes on the edge serving as a guide to grading between the holes. By repeating the operation for each of the sizes we produce the set. A similar result may be obtained by the method shewn at Figure 4. Radial lines are drawn through an original shape, as A B C D, etc., the proportional amount required on the toe is then marked; straight lines are then drawn connecting each one of the points made on the outline. A straight line is drawn across the joint. Half the required amount of difference to be made across the joint is marked off on each side, as A B C; lines are then drawn parallel with the line BD, as shewn BD, Cd; parallel lines are then drawn to the line DE, passing through the different points made between Dd, and cutting the line, as Ee; this operation is repeated between EF, FG, GH, HI, IJ, JK, KB. The operation may be carried round in the opposite direction, until the centre of the toe is reached, meeting the grade from the opposite side. This is called the "Parallel method," and is sometimes carried out by the aid of a tool called a parallel ruler. The points found are pricked through as stencil points, and connected in the same manner as described for the "Radial system."

In each of these systems it is not theoretically important where the "Radial centre" is taken, but there are practically convenient points which assist in producing the correct grade. Figure 5 shews the method of grading top-pieces or lifts. Figure 6 the radial tool used. In this case the length of the line AB is longer than the object to be graded, this is of no consequence if the difference required is marked across the tool at a distance from A equal to the length of the standard or of the part fixing the grade, as BCD (Figure 6). The grading point in this case has been taken outside the object, as point A, Figure 5.

Mention has been made that the different width of sole shapes produce different grades between size and size; this is illustrated at Figure 7. The line AB represents the length of the shape. The difference in lengths is marked, as 1, 2, 3, 4, 5, 6, 7, 8. The proportionate difference in the length of forepart is shewn at D 1, 2, 3, 4, 5, 6, 7, 8. Different widths of sole shape are shewn at E, F, G. As the same radial tool would be used for grading each one of these widths, and as it is evident that there is a difference in width between HI, and IJ, there would be a difference in grade between sole shapes of corresponding different widths. If we assume that the width required was in the proportion of DE, and having marked the point D, we first determine the grade from the radial tool to the point D, and then transfer it to the point F or G, we should get the grade naturally thrown by the width DE at the other points. The practical application of this is shewn at Figure 8. We assume the line length of the sole shape to be AB; that the radial point is selected, as shewn; that the amount of grade desired is found upon the tool, Figure 1; we will assume that the grade required is 1/3rd-of-an-inch in length and 1/12th-of-an-inch difference in width—this difference in width would represent a quarter of the difference in length; we should now compare a quarter of the length of the tool with the width of tread of the sole shape to be graded, as CD. We will assume the quarter length to be as CE. Next construct a tool, as Figure 9, in which AB represents CE across the sole shape, and BC represents the difference ED; now apply it as shewn on the diagram; draw lines across the sole shape at right angles to the centre line, as shewn; place the point A of the auxiliary tool upon the centre line with the line AB on a cross line, fold it down where it crosses the outline

of the shape, mark the width of the fold from the edge of the outline along the cross line, producing points as G H I J K L M N O. Now from the radial centre draw lines from each one of these points; draw lines through the outline of the sole shape at the end of each of the cross lines parallel with the lines coming from the centre, as G H I J K L M N O. Now grade with the long radial tool by taking the grade from the radial centre to each of the inner lettered marks, and transferring that grade to the outer edge of the shape at the points corresponding to the inner points; this will produce a symmetrical pattern to the proportionate grade required. This is called the "Transferred radial system."

Another application of the cross grade is used in producing a set of fittings. In this case we require differences in widths only, keeping the differences in length constant. Figures 10 and 11 explain this. The sole shape, Figure 11, has a line drawn down its centre, as AB; cross lines are drawn through its principal points, as shewn, and the width of the tread CD used for the construction of a special grading tool. Figure 10 represents this grading tool. The line AB is the width of the sole shape. BC, at right angles to AB, is marked with the differences required in widths. These points are connected to A. A margin is left on the top producing the tool as shewn. The application of the tool is shewn at FG, Figure 11. The point A is placed on the central line, with a line AB on the cross line, as EF; the paper is folded where it crosses the outline, as at FG; the grade across that part is left on upon the cross lines as the point shewn. This being repeated round the shape produces a stencil: the stencil is used in precisely the same way as in grading sizes.

Figure 12 illustrates the method of grading inner soles and outer soles from one stencil. The inner sole is marked inside the outer sole, as shewn. The radial centre is determined at the joint as point C, and the transfer points found as described by the transferred radial system, as shewn at points 1 to 15; the grade is first transferred to the inner sole and then to the outer sole, producing the two grades on one stencil.

Another method of producing a number of sizes is by what is termed the "Comparative method." By this method a grade may be made between two patterns of very different shapes, as between an infant's pattern and an adult's. The small pattern is drawn inside the large pattern; a tool is then made as Figure 13. A line AB has a line drawn at right angles to it and upon the inside of the point B; amounts larger than those required in the grade are marked as 1 to 7; each one of these points is connected to the point A. This produces the comparative grader. If it is folded down in any part so that the point A is on the line AB, the lines across the grader will be at equal distances apart—the amount in proportion to the distance from A. It is applied by connecting the points on the two outlines mentioned by straight lines, placing the grader at right angles to the straight lines until the outlines of the large and the small patterns touch the two sides of the grades; it is then folded down level with the connecting line, and the grade shewn on the grader pricked through on to the lines. This is repeated upon each of the connecting lines, producing a comparative stencil. The points are connected precisely the same as with a radial stencil. Specimens of grading by this method are shewn on the Plate illustrating pattern grading.

The tool shewn upon Plate 19 will be found very useful in carrying out the operations of cutting patterns. Figure 1 shews the side intended to be used in cutting short work. In addition to the standard measurements of lengths shewn on the base, the vertical edge at the back shews counter heights, shoe quarter heights, ankle heights and ordinary English inches. There is also a point and sub-divisions, in which the centre is marked two-and-a-half inches. If that point

is placed on the front of the pattern at the height that the vamp is to be, while the straight edge next to it is upon the counter height, when that counter height is two-and-a-half inches the curve between the points will represent the correct curve of the golosh. The other differences represent differences of 1/8th-of-an-inch in the height of the back golosh. The shoe quarter lengths represent the differences between the counter points and the point F described in cutting a shoe pattern. The point TP and the curve line from it marked "Instep," represent the front of the pattern from the instep point to the ankle, when the point TP is on the heel line. The line "Heel" CP, and the line above it, represent the curve at the back of the pattern when CP is on the counter point with the heel line below it and the curve above touching the back of the heel, as shewn, Figure 4. Figure 3 shews its use in making right angle lines. Figure 2 is intended for use in cutting long work. The base line marked in inches has also counter lengths, and the pitch line described in cutting long work. The other edge has the counter height for long work, and the pass height. The points TP and CP are also shewn, as they are sometimes required upon both sides of the tool.

A "forme" is the reproduction in paper of the outer surface of a last, from the edge of the sole to the line representing the centre line of the boot. Where the upper pattern of the boot is to be cut as straights, only one forme, that of the outer side, is required. It is sometimes the custom to cut a separate forme for each side of the last when producing a straights pattern, in this case the two formes are placed one over the other and the distance between them divided; the result is the production of a mean shape between the two. This would represent the average shape of both, and would therefore be too large for the small size and too small for the large size. In practice it is found that it is better to either cut rights and lefts, or to the larger side of the last.

The first operation towards cutting a forme is to divide the last down the centre by a straight line. This line should be drawn from the instep point to the centre of the toe down the front, and from the counter point to the centre of the seat down the back.

Lay the last upon its side, as Figure 1, Plate 20; draw round the profile of the last, as A B C D E, then make cuts in the paper, as the lines between A, B, and C D, and D E, Figure 2; place the paper against the side of the last, as Figure 3, and pin it down at the points shewn, then fold each piece of paper separately over the last across the centre line, and mark each piece where it crosses the centre line, as Figure 4.

Some cutters prefer to cut out V shaped pieces as, Figure 1, Plate 21; the processes are precisely the same as before; the appearance of the paper when on the last being as Figure 2. In either case the result is the production of a piece of a paper marked where the centre lines of the last are crossed by the paper, as Figure 3. The next operation is to cut through these points, producing a forme or shape of the side of the last, as Figure 4. This is repeated for the opposite side of the last, making a pair of formes.

The pattern of the bottom of the last should be the correct shape of the seat and the forepart, from the corners of the seat round the back, and from the corner of the joints round the forepart. The waist must be fashioned to the needs of the particular style and to the taste of the pattern cutter. The average proportion of width of waist is three-quarters of the width of the seat, but considerable differences are made from this in practice. Sole shapes are fashioned to produce a certain style—that may be according to a passing fashion; but as a rule the lightest classes of work should have

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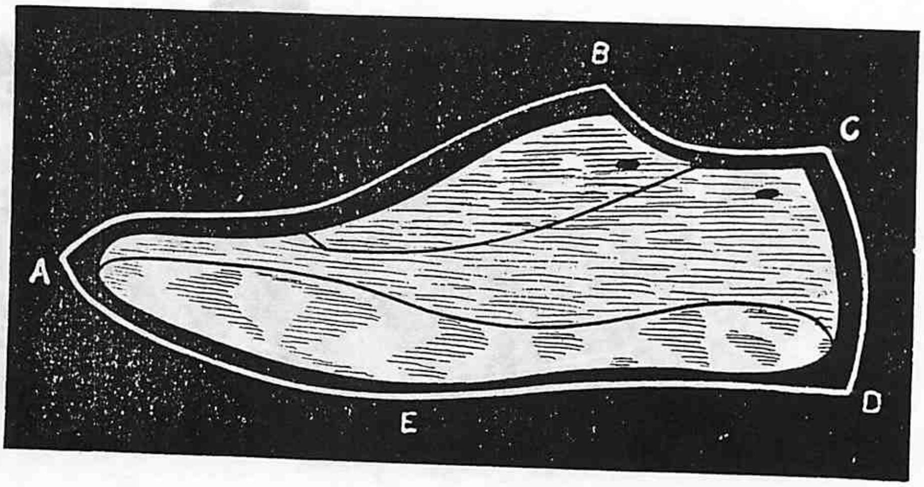
Plate 20.



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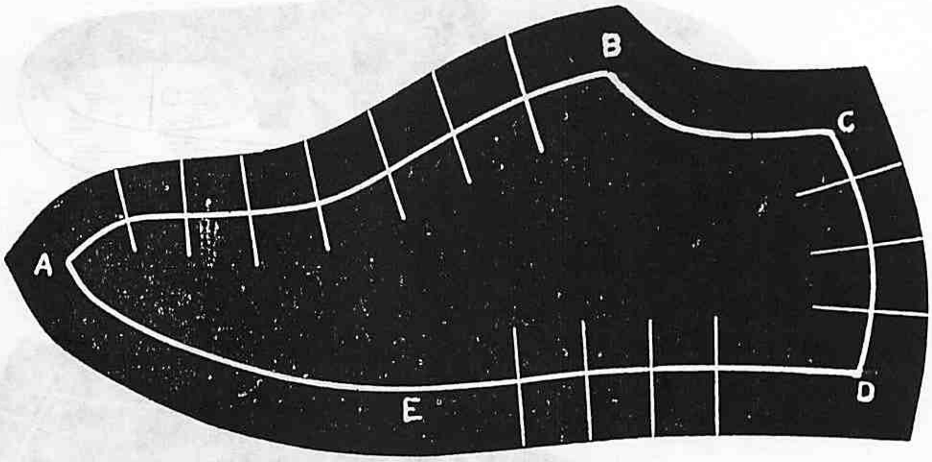

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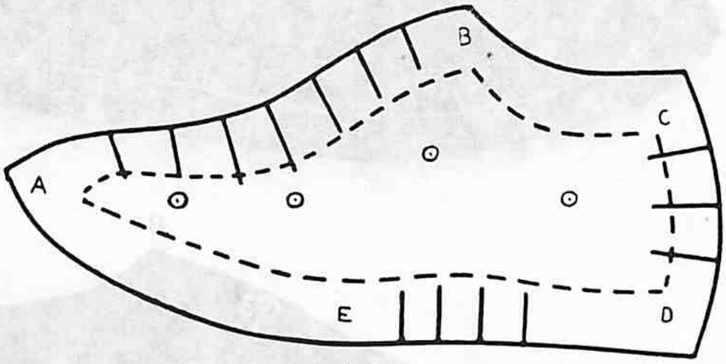

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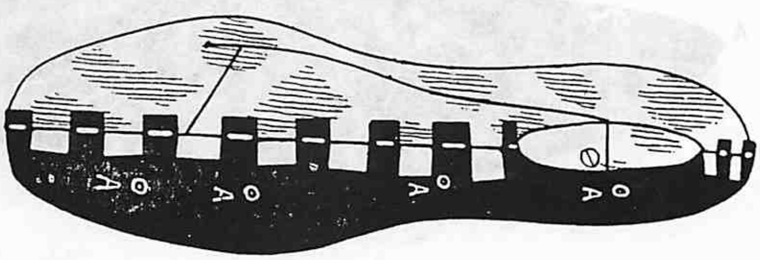

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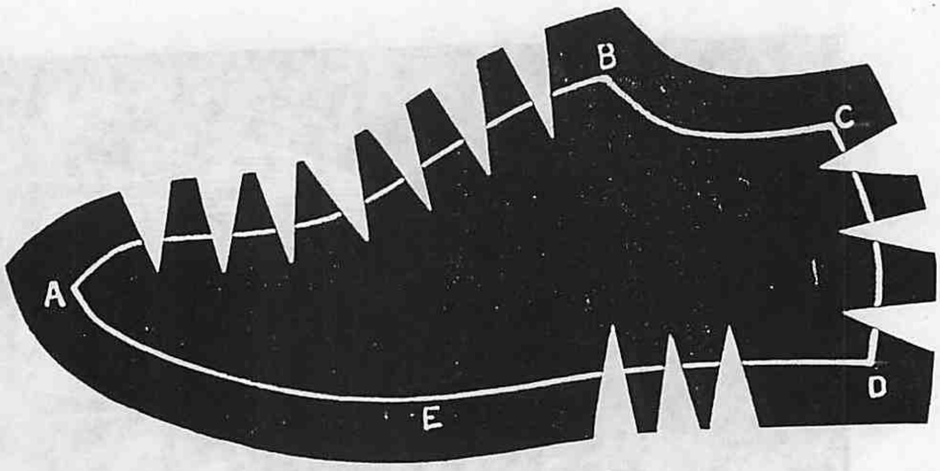

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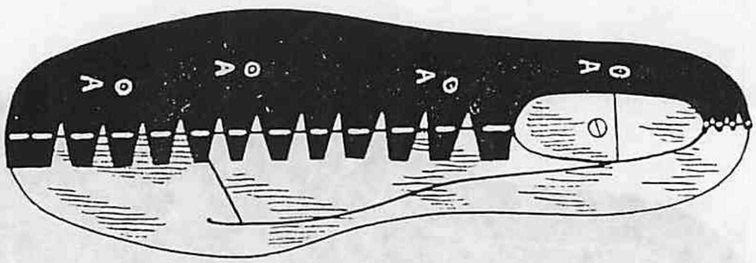

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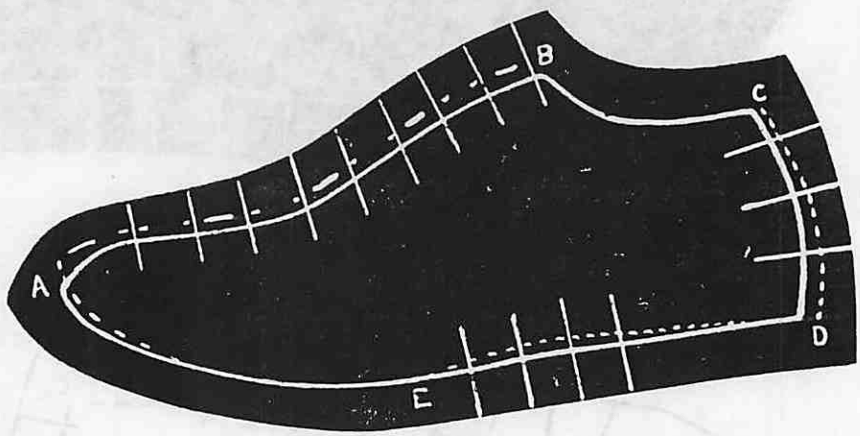
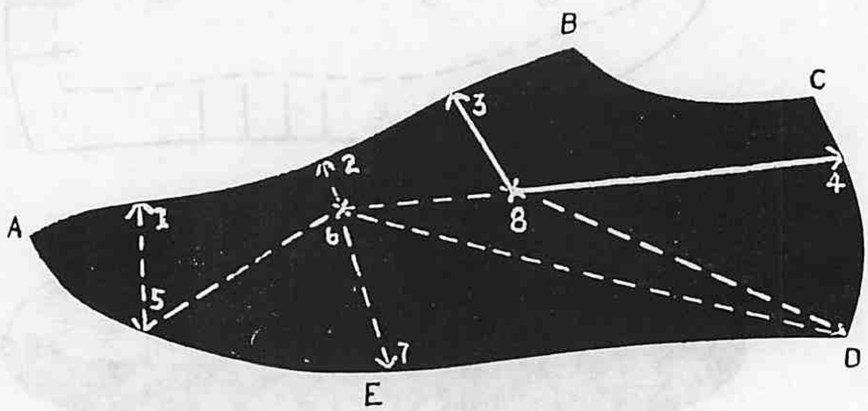




4.

The Production of the Forme.

the narrowest waist. Therefore for very light work the waist may be less than the proportion given; for stout work certainly very much wider. This is one of the matters in which the student must train his eye and taste. The specimen of sole shapes illustrating finishing may be of some assistance in this.

A simple method of taking the pattern of the bottom of the last is to first tack a piece of paper on the bottom, beginning with a tack in the toe end, and smoothing the paper towards the seat; put a tack in the tread, another in the centre of the waist, and another in the centre of the seat. If it is a wood last a few others may be put in towards the edge. Now smooth the paper towards the edge of the last, without dragging at the tacks, and gently over the edge; this will form a crease on the paper all round the sharp edge of the last. Now file the edge of the paper where it comes over the last, using a small fine file; this will cut through the paper along the crease made, and produce the precise shape of the sole, except at the waist, which must be shaped by the pattern cutter's skill as described.

It must be evident that a flat surface cannot be blocked down to fit over any object of two curvatures, and therefore, at the best, the forme is only approximately the shape of the last. The actual fit of the last by the pattern must be obtained by direct measurement.

The measurements necessary for this must be obtained direct from the last: the method being shewn on Figure 1, Plate 22.

There are some exceptional points which should be emphasised when teaching the method of cutting a pattern to a last, and certain measurements which are indispensable. We must have the length of each side of the last from the counter point to the centre of the toe, as AB. A line should be drawn straight across the line down the centre of the last at the vamp height E, as EFG. FG being about an inch from E. The sides of the caps should be marked as IH. Now with these points we are able to determine the lengths of the various parts of the lasts as GC, FC, GI, FH. When reproducing these lines upon the forme, we first mark the height of the counter at the back, then the relative position of the point E; this may be found by either drawing a line one inch from and level with the front line, or by making a semi-circle one inch from E, and measuring from the counter point to a point on the line or semi-circle equal to the distance found on the last; this will give the correct lengths between the counter point B, and the joint points F or G.

The distance between the counter point and the bottom of the last is shewn upon the forme. To determine the true distance between the joint point and the centre of the seat, the length as taken from the last is measured from F and G towards C. It is generally found that the forme taken from the outer side of the last has the counter line longer than that of the last. It must be evident that it is not correct to take the whole of this difference up in one place; there must be some loss or gain of length at the intermediate parts.

An examination of the last will shew that the counter line from the counter point to the line crossing the instep, is almost straight, the loss or gain in line length is mostly between that point and the joint point. To focus the actual amount, a point has to be found on both sides of the last, somewhere along the counter line, that will enable us to measure between the point found and the joint point.

To find the comparative length of the two counter lines and the position of the loss or gain to both, we must first find corresponding points on each side of the last; this is probably best done by a method, as shewn in Figures 1 and 2. The line XY is drawn upon a piece of paper, the last is stood upon it, so that the line passes exactly under the centre of the toe and the centre of the seat; a cross line at right angles with XY is drawn to pass out at J. If an ordinary set square is placed parallel with XY, and with its upright edge level with J, this vertical edge would occupy a line as KM, while the base will be as KL, this will enable the point J to be marked upon the last, in the same relative position to the line length of the last on both counter lines. By measuring from J to F and B upon the outer side, and from J to G and B upon the inner side the actual position of gain or loss in line length can be seen by the comparative lengths of each.

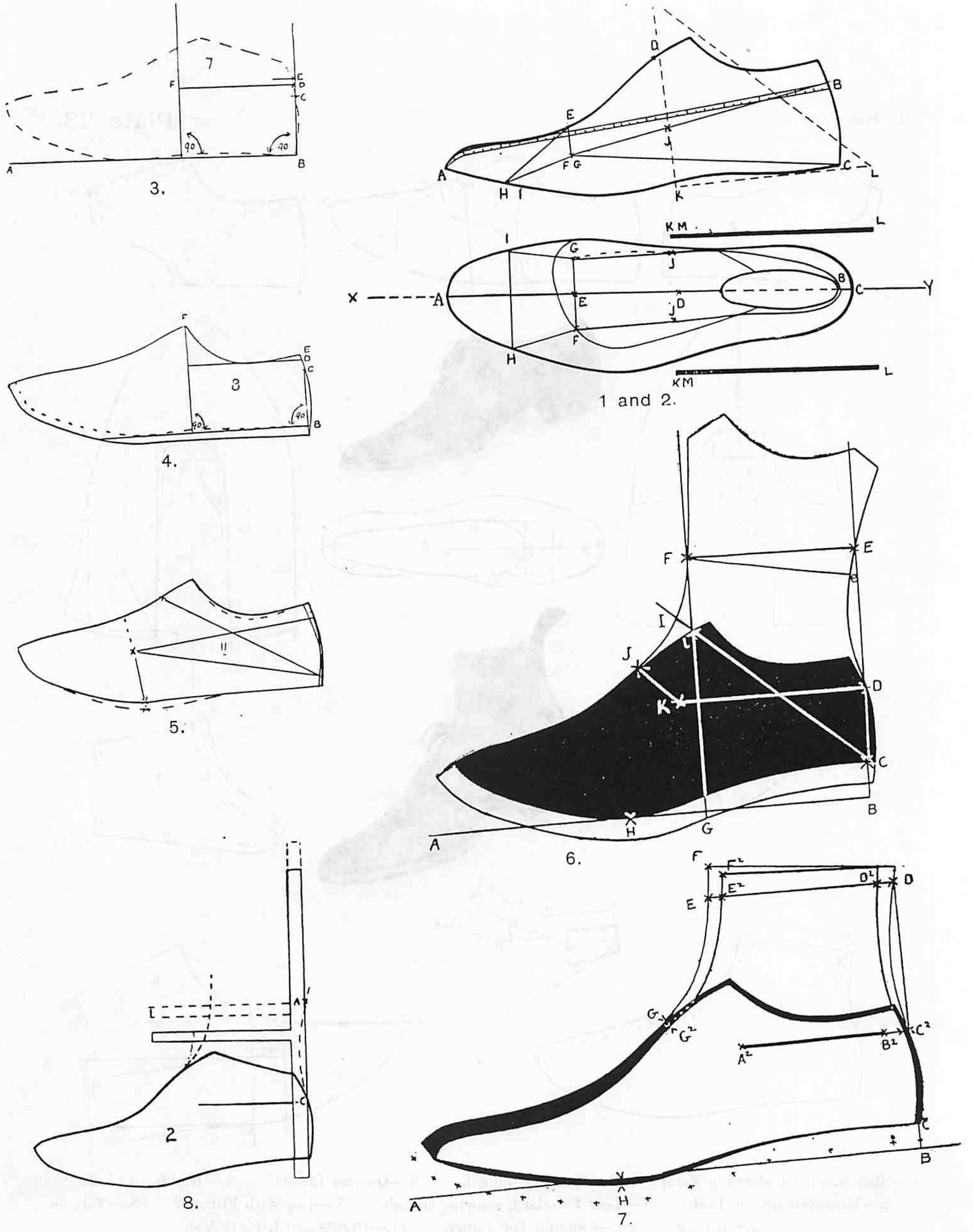
It is the usual practice to take all measurements up the front of the last and up the front of the pattern, but it must be evident that, as the upper is pulled from the front and held by the back seam, that the relation between the back seam and the back of the last decides the distance of each point of the front from the back seam, and therefore upon the front of the last. It is quite useless measuring four inches up the front of the last for the height of a vamp, if the upper is one size too long in the length at the back. The vamp pulls over the toe one size too long, and is therefore the same amount short in the front. The correct height of a front of a boot is determined by having the correct length from the point wanted to the back seam.

The forme produced from the last nearly approaches in shape to a shoe pattern. The curve to be made is the curve from the instep point F to the back of the shoe E. The construction lines for the production of a shoe are as Figure 3, Plate 22, shewn. A B represents the ground line; B C D E, a line at right angles; C, the counter point, taken from the scale given; D, half-an-inch above the counter point; E, a quarter-of-an-inch above D. The spaces C D E are constant in all sizes. The line DF is taken parallel with the line AB. The line F is at right angles with the line AB. The line F represents the distance between the top point of the quarter and the back; and the line DF represents the height of the quarter at the side. A curve should be cut from F down to the line DF, and up to the point E, as shewn—Figure 4. This produces the standard shoe pattern.

Seeing that the two ankle bones are not level in the foot, it follows that the two shoe quarters should be cut in the same proportion heights as the ankle bones; therefore, the inner quarter of a shoe should be cut about a quarter-of-an-inch lower than the outer quarter. This difference is shewn—Figure 5. Upon this same figure, in dotted lines, is shewn the difference between the two formes. It must be evident that the front seam should be the same shape in both formes. Therefore, if the two formes are put so that they coincide down the front, the difference in their shape will be shewn at the bottom. There is, however, a difference in the length of the sides along the counter line. This difference is ascertained by the method already described, and being measured off from the joint point, is allowed for at the back seam, as shewn.

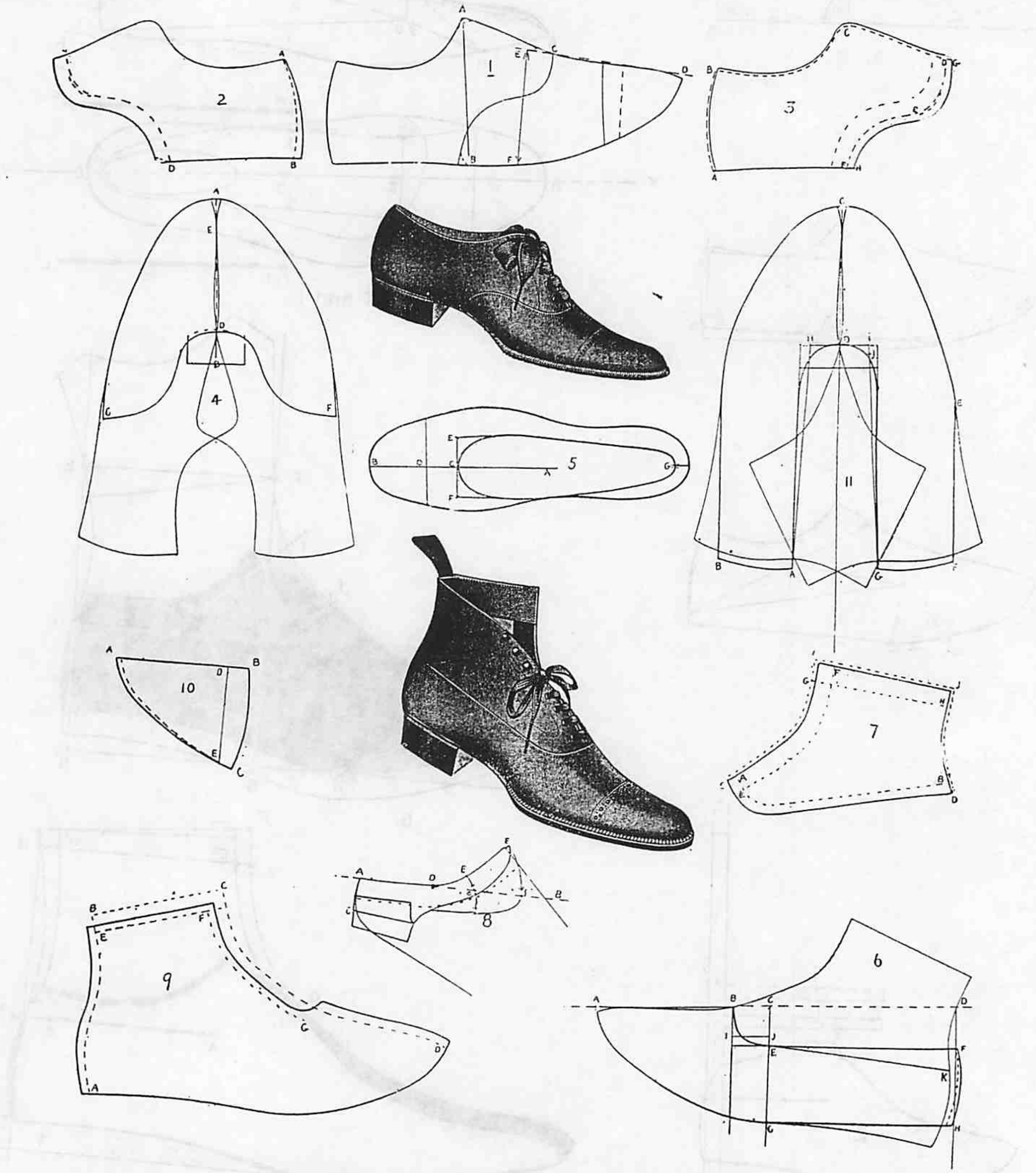
The method of cutting the shoe vamp is shewn on Fig. 1, Plate 23. The standard pattern is laid against the folded edge of the piece of paper, as CD. The line AB represents the length line of the quarter which will be already upon the standard. It is usual to cut a vamp pattern for a shoe about a quarter-of-an-inch lower than for a boot. Assuming CD to be the height of the vamp, the length of the wing of the vamp should be to a point about half-an-inch behind B. If it is desired that the vamp should lock in, mark a point CE at one-third the distance between CA; draw a line at right angles, and mark a point at one-third its length from E; cut the curve to pass through that.

To face Page 48.



Determination of True Ground Line.

Plate 23.



1.—Shoe Standard, shewing Vamp. 2.—Quarter—outside. 3.—Quarter Lining. 4.—Rights and Lefts vamps. 5.—Measurements of Last. 6.—Boot Standard, shewing Golosh. 7.—Leg with Fittings. 8.—Tongue. 9.—Lining. 10.—Cap and Toe Joiner. 11.—Rights and Lefts Golosh.

The rights and lefts shoe pattern would be best produced by cutting two distinct patterns to separate forme—one for each side of the last. Assuming the vamp pattern to be cut like Figure 1, this will produce a vamp with one side the correct size. To correct the other side of the vamp lay it out flat, marking the centre line as AB (Figure 4). A E D F will represent the large size. Place the smaller side so that it touches the centre line at AE D, and cut the true shape from A to G. The curve may be modified as in the golosh as shewn by the dotted line ; this dotted point is also shewn in Figures 2 and 3. The allowances for the lap seam should be from the outer point.

It is a bad practice to have too many seams to finish at the same place ; therefore, in cutting shoe quarter linings the end of the lining should come in front of the end of the outside, as shewn—Figure 3. AB represents the ordinary seam ; there is of course no allowance for stiffener on the lining. BCD represents the top edge ; if turned in, a sixth-of-an-inch is required ; if to be trimmed off by machine, allow one-twelfth-of-an-inch ; if bagged tops, allow one-sixteenth-of-an-inch ; but in the case of bagged tops, the linings should be cut true to the shape of the outside along the top edge, to allow of their both being seamed together. DF represents the edge of the outside. GH is a quarter-of-an-inch allowance in front of it.

The cutting of low shoes, like court shoes, sandals and bar shoes, require some consideration of the effect of draft and strain upon the upper during the process of making. Plate 24 will assist to explain the principle upon which these shoes should be cut. Figure 1 represents the outside of the forme taken from the last. AB is the desired height of the vamp, when made. The line below the outline of the forme represents the allowance for lasting, H is the counter point. F E the desired height of the back.

The forme should be cut accurately to the last ; fitting over the toe end precisely, draw a line from A to H ; mark a point C one inch from A ; draw a line at right angles to AC as CD. From D draw DE. The curve of the front BGE should not come below the lines AH, DE. If brought below the line AH as at G, when the first pull is taken over the toe the shoe would be pulled out of shape at G. The curve should be cut as the inner line BGE, but may be cut lower than E towards H, if desired. The application of this principle on the flat is shewn at Figure 2. AB, B2 represents the folded edge of a piece of paper. B or B2 is the height required. C is the distance marked as Figure 1. CD the cross line described. The curves BG, B2 G, are cut to suit the taste of the designer ; they may be made round or square, or any degree of curvature, but should not come below the lines AH, DE. It will be observed that as the point B moves towards the toe the opening becomes narrow and wider as it moves away from the toe.

A great deal of this work is cut for turned shoes (Sew-rounds) ; these being made inside out, and in England, with the back lining seamed up, have the lining cut longer than the outside. The relative appearance is shewn at Figure 3. The dotted line represents the outline of the outside ; the solid line the shape of the lining. AB is the folded edge of the lining ; CD the lap seam going under the back quarter ; EF represents the lap of the back quarter over the front lining ; FG is the allowance for seaming, or folding, or turning, along the top edge ; GH the relative shape of the lining and outside. The linings should have a quarter-of-an-inch allowed over the outside, at the point H, that amount being gradually left on from the point G. At H, the lining would be a quarter-of-an-inch less than the outside along the bottom, graduated to nothing at the point D, as seen upon the diagram. Figure 4 represents the application of this principle to a tie shoe. The outline of the

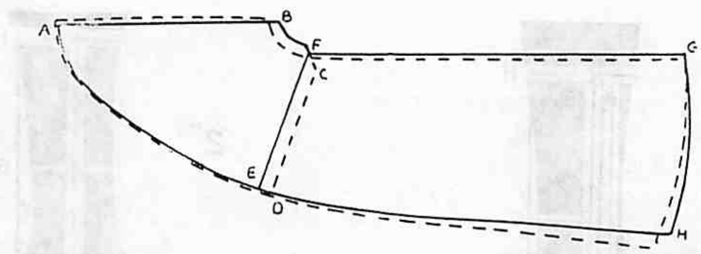
forme is shewn as before, as A B C D, and along the back and bottom. AB is the required height, and C the required quarter-height. The curvature BC may be cut to suit any required design, so long as the lowest point of the curve is kept above the lines previously described. In this particular design it is proposed to tie the shoe across the front with two silk bows. Figure 5 is an application to a sandal or bar shoe. The principles already described apply to this, the only fresh matter being the strap G. Commonly, this strap is cut quite straight; it should be cut to curve round the instep; the method is, first to cut the profile of the shoe, leaving sufficient material EF to fold down, as shewn. The outline is then cut precisely as for a lace shoe, when the paper is opened it will be found to have taken a curve as G. The appearance, when folded down, being as G2. The curve DH should be cut to the individual taste. The vamp IJ may come above or below the quarter, but as the seam of the vamp IDH stiffens that part, some latitude is allowed in the width of the opening.

A pattern for a boot really resolves itself into attaching the leg portion to the forme of the last already cut. The simplest method of doing this is by means of construction lines—Figure 6, Plate 22, shews an example of this. The line AB represents the ground line; BCDE is a line at right angles to it. It must be evident that the back curve of a boot if stood with the heel against the vertical line will touch the line somewhere about the ankle, and if we assume that the back counter point of the forme be placed against the vertical line while the seat point C is raised the height of the heel the boot is to carry, a point may be taken up the line that will give a correct curve between the ankle point E and the counter point D. The ankle line of a pattern is usually cut half the girth of the joint of the last; therefore, if we measure from the point E that amount forward, we obtain the point F. EF represents the ankle line. The cutting of the curve between the instep point and the point F requires a considerable amount of skill; it may be made with a tool shewn upon Plate 19.

To determine the instep point upon a forme, draw a line level with the ground equal to half the length of the last from point D; make a line at 45° with this line, as KJ: where it crosses the outline of the forme is the instep point.

To cut a pattern with the tool on Plate 19, proceed as follows:—With the right-angled edge of the tool, draw the line ABCDE; from B, mark BC the height of the heel: shift the tool up, as Figure 3, so that the edge of the tool is equal with the height of the heel; mark the point D the counter height, and E the ankle height, taking each from the scale upon the tool, seeing that you mark to the correct size. Now draw a right-angled line from the point E, as EF, using the base of the tool for the purpose, along that line mark half the girth of the last at the joint. Draw a line from the point F straight down to the base line, as FG; now place the forme as Figure 4, so that the edge of the joint is on the base line while the back is against the counter point, and the bottom of the heel on the point C, as shewn; mark carefully round. The remaining curves may be made by using the tool. First draw the heel line—this is found by drawing a line from the point C through the point where the edge of the forme passes through the line FG—place the mark on the tool TP upon the heel line so that the one edge is against the point F, while the instep edge is against the instep of the forme, as shewn in figure 4; draw the line between the instep point and the ankle point: this completes the front of the pattern. The back curve of the pattern may be taken from the tool also. The point CP on the tool represents the counter point, it should be placed upon the point D on the construction line, with the line marked "heel" towards the lower part of the forme, and the other part of the curve passing through the point E; this will give the line representing the back curve of the ankle, and

Plate 24.



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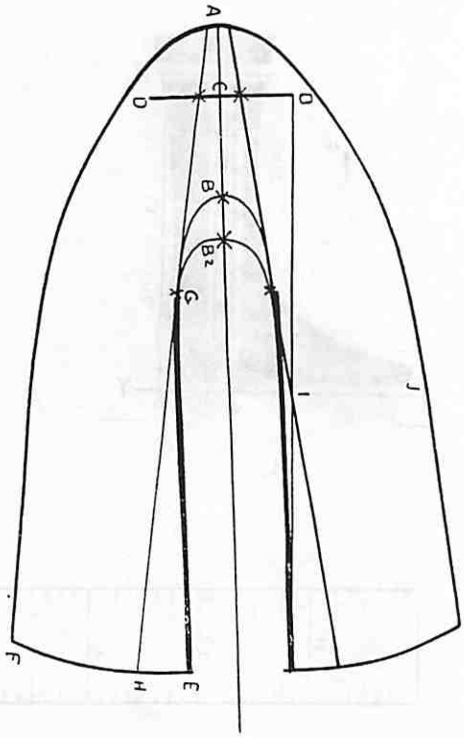

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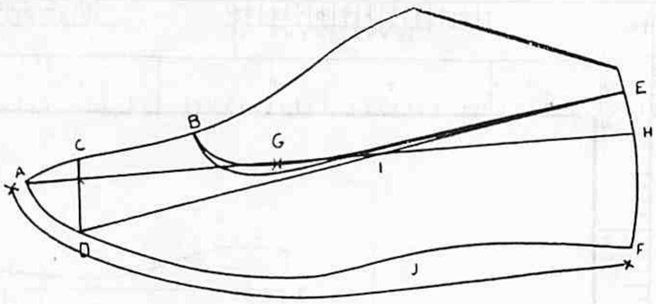

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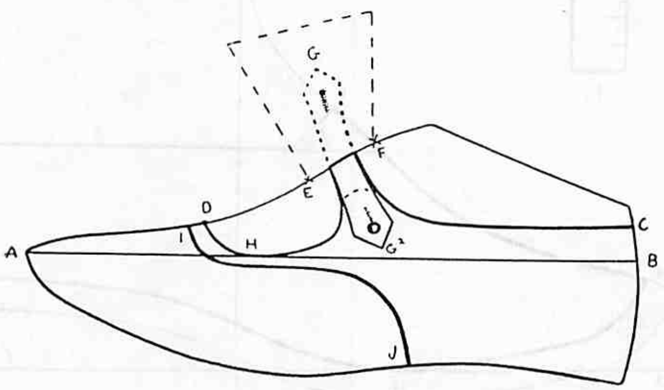

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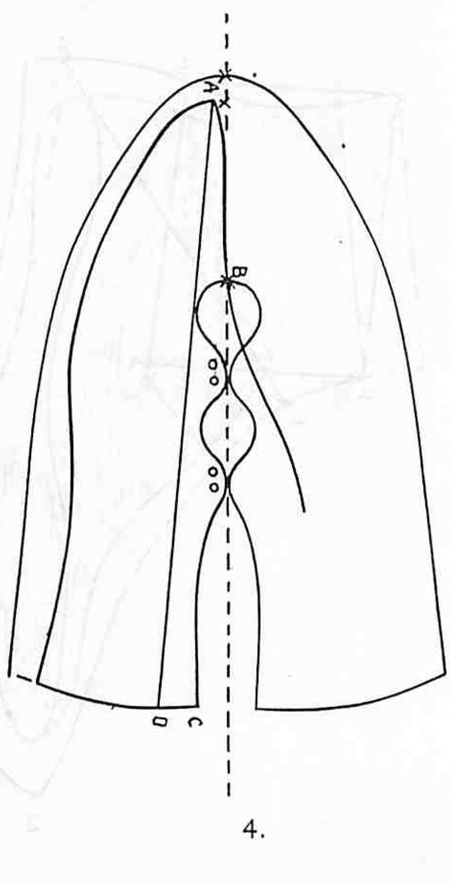

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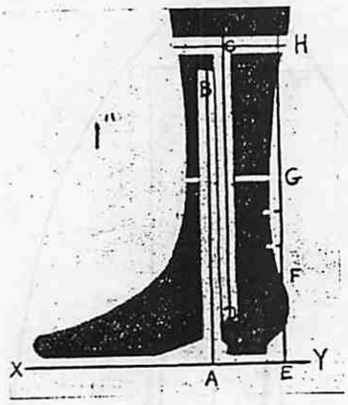

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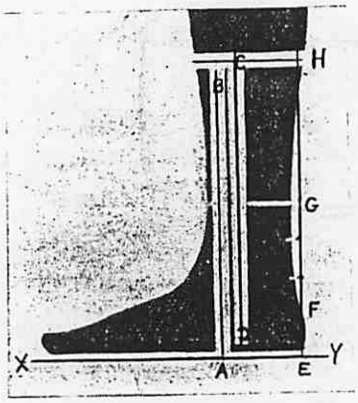
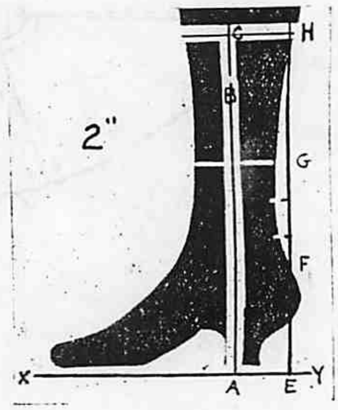


Determination of the "Pitch." (3.)



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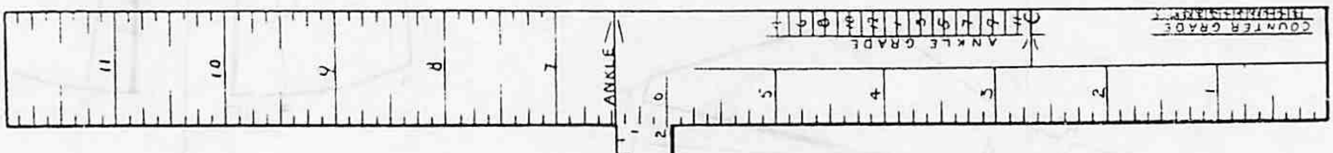

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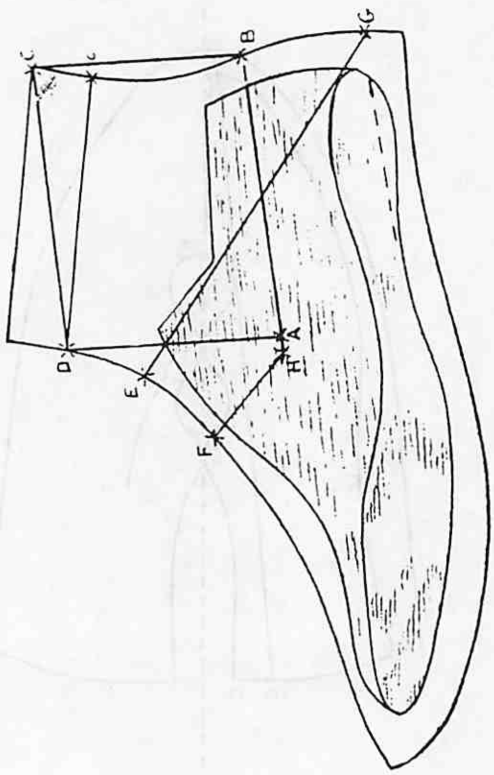

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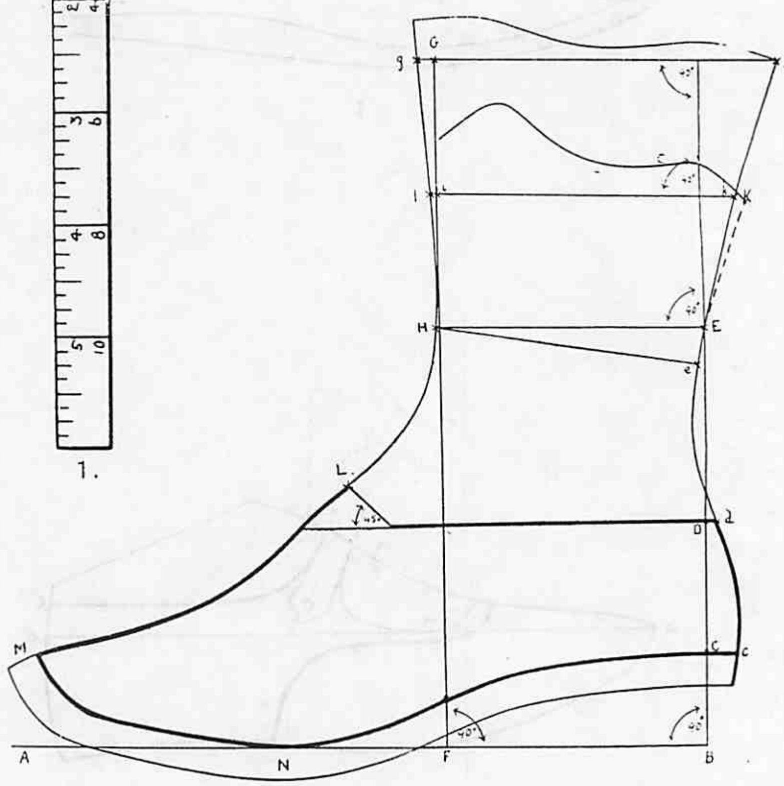


6.

completes the standard pattern. The next operation is to leave on the lasting allowance. This lasting allowance should be a quarter-of-an-inch for light hand-sewn work; three-eighths-of-an-inch for heavy hand-sewn work; half-an-inch for light machine-made work; and five-eighths-of-an-inch for stout machine-sewn work. This completes the standard pattern (see Figure 6, Plate 22).

A standard pattern for a boot is defined by a pattern which reaches above the forme of the last. It is evident that the forme of the last and its relation to the ground will vary as the last varies in its relation. The leg portion of the boot varies in its relation to the ground, and to the forme or last. Figure 7, Plate 22, illustrates this. The line AB represents the ground line. The difference between the forme and the last is shewn by the outline of the last upon the black paper beneath. The relation between the leg and the last and the forme, are shewn by the relation between the point C, C2 and C2 D, and C2 D2. As the point D is moved to D2, the front portion of the leg EF also moves. This moving backwards or forwards is termed the pitch, and the lines which define them are called the pitch lines. In dealing with this subject, the vertical lines that pass through the counter point and ankle point at the back and through the ankle point in front, will be referred to as the back pitch line and the front pitch line respectively. The front curve of the leg above the ankle line can only be defined in its relation to the ground by its relation to the front pitch line. It will be referred to as the inclination of the leg. The curve between the ankle point in front and the instep point will be referred to as the throat curve. The curve between the counter point and the back ankle point will be referred to as the ankle curve.

It is evident that the relation between the last and the ground line is constant in all fittings of lasts, no matter what their shape; but the relation between the forme of the last and the ground line varies with the swell of the joint and range of the last. Figure 7 illustrates this. If we assume that the line AB is constant on both last and forme, it is evident that when the forme is flattened out, some portion of its difference in area will be developed downwards, and that if we place the joint point upon the line AB, the toe will be elevated too much. It therefore follows that the line A2 B2 represents the true ground line upon the forme, and it would be the more correct way to disregard the nominal ground line, and to use A2 B2 upon the forme as representing it. The method of working to this is shewn upon Plate 25, and the tool to assist in its working, upon Figure 1, same plate.

The Figure 2, Plate 25, represents a pattern produced upon this method. AB is the counter line. BC is a line at right angles. CD AD are at right angles. The relation between AB and CD now represent the pitch, as explained before. The working is precisely the same as in producing patterns by the method previously described, except that the height BC is taken at the ordinary ankle height, less the counter height. The tool shewn is constructed to assist in defining these measurements.

There is also considerable difference required in the relation of pitch point with the pitch line, according to the method of lasting the boot and the nature of the material. Where the curve between the counter point and the pitch point is as Figure 6, Plate 22, the pitch is referred to as the normal pitch. It is suitable for light work lasted by machine. The differences in pitch are defined by taking amounts along the ankle line, forward or backward, and are referred to as a forward pitch or a backward pitch, stating the amount. For instance, in Figure 7, the point D might be moved to D2. As a rule, all hand-made boots are cut with 1/8th-of-an-inch more backward pitch than

machine made (See Lasting). Medium substance work should have 1/8th-of-an-inch forward pitch, stout work 1/4th-of-an-inch forward pitch.

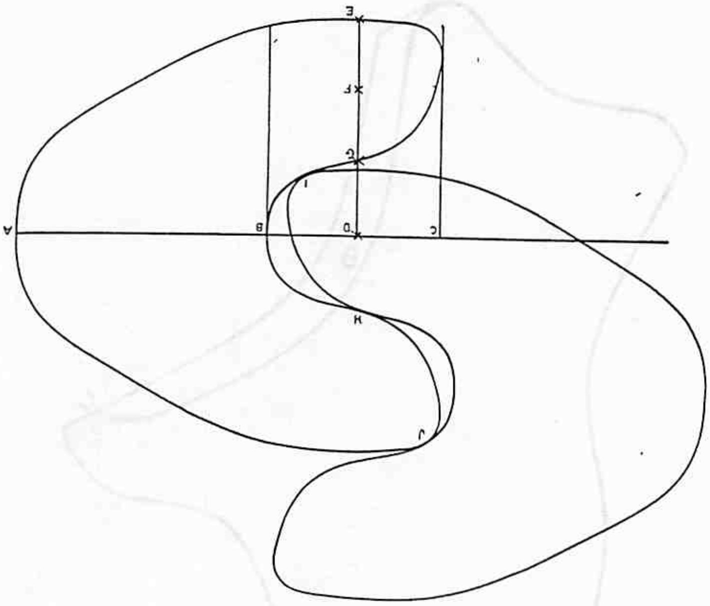
The relation between the foot which is represented by the last in shoe making and the leg is shewn upon Plate 24, Figures 3, 4, 5. It will be seen that its relative position has been determined by the relation between a vertical fixed line—A B, that has a constant relation to a horizontal line—X Y, and which is compared under various conditions, as to height of heel, with a fixed line on the leg—C D. This line upon the leg was arranged to be paralleled to A B when the foot stood upon the ground without any heel. As the heel was raised half-an-inch at a time, the relative position of the leg, foot and the line were photographed. It was found that at half-an-inch and one inch the lines were practically parallel. At one-and-a-half-inches there was a forward pitch to the top of the leg. At two inches the lines were again paralleled, although the line C D had moved forward a considerable amount.

From this we may infer that for practical purposes a vertical line may be assumed for all heights of heel. We could scarcely make an alteration at one-and-a-half-inches only. The peculiarity at this height appears to have been personal to the subject being examined; but it was repeated during several experiments.

It will be observed that the front of the leg is by no means parallel with the line A B or the line C D. There is a distinct forward curvature at the top end of the line H; in fact, the curvature forward appears to nearly equal the curvature backward. This at once proves that the straight, upright line generally cut for high leg work is entirely wrong. The curvature of the leg at the back above the counter point varies with the height of the heel, comparatively, when flat on the ground, the back curve is slight, bold in its curvature, and the heel not very prominent. As the heel is raised, the curvature immediately above the heel becomes more acute, until at two inches the relative shape of the foot and leg are quite different. The actual measurements based on these observations have been used in constructing the pattern illustrated on Figure 6.

Figure 6 represents the pattern. A B is the ground line; B C D E the pitch line; D is the counter line; the point L the instep point. The lower part M N C D L is taken from the forme in the ordinary way. E H is the ankle line; K I is taken two inches above E H; J G is taken two inches above K I. The vertical line G H F passes through the ankle point. The distance between G g is first marked at a quarter-of-an-inch; the curve L H I g is then cut. From H towards G, half the ankle girth is marked. One-and-a-half inches is added to the girth of the ankle measure, and provided for in I K. One-and-a-quarter inches is added to this measure, and provided for at G J. The curve cut through these points produces the high leg pattern; H e is equal to H E.

Some little difference is required in the top part of the curve, according to the fitting. In wide fittings, the swell between J and K should be increased. In very narrow fittings, it should be a little less. These differences are owing to the different swell of the calf, just above the point J. This diagram also shews the relation between the ordinary cut low leg boot and a high leg boot. K, and the curve from it, shews the usual method of cutting the boot up to seven inches high. It is not quite accurate, but it is the usual custom, and the difference between it and accuracy is not of much practical consequence.



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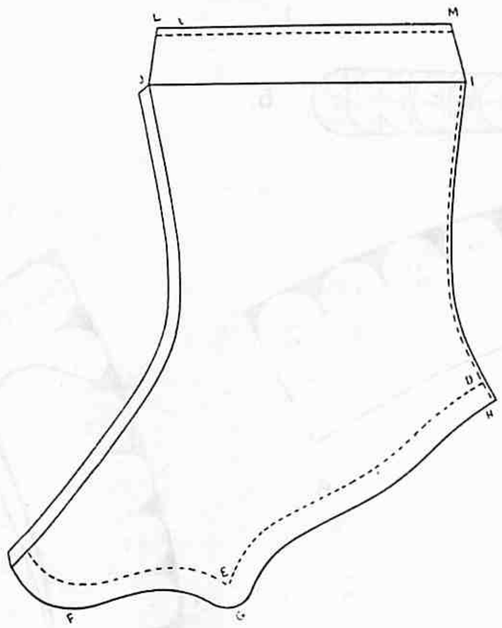

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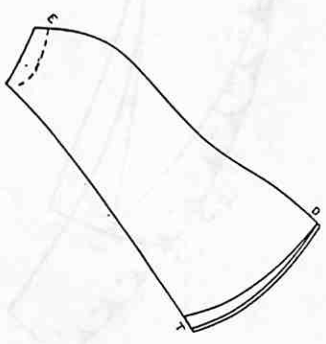

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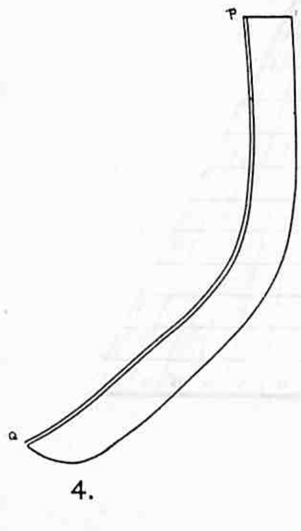

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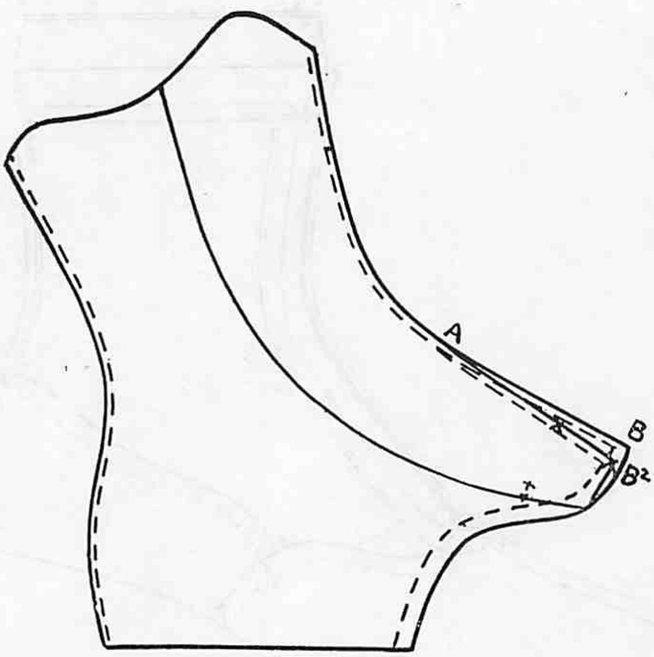
Plate 27.



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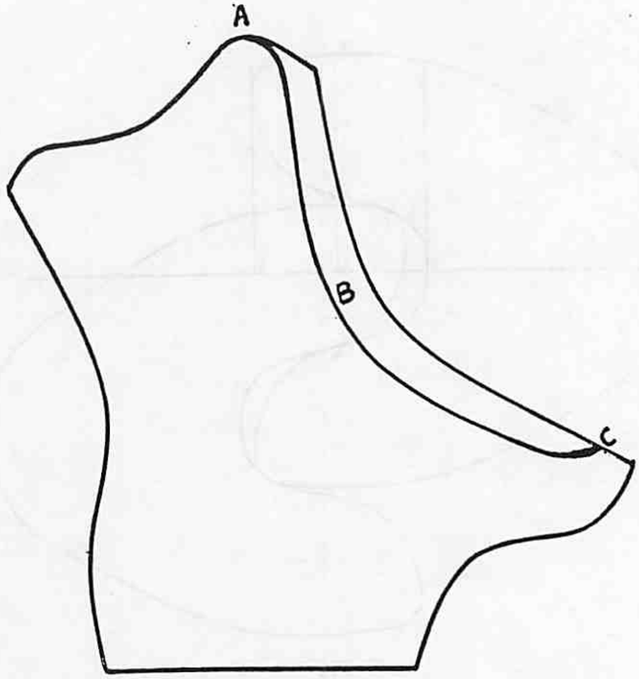

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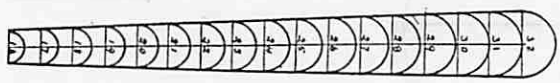
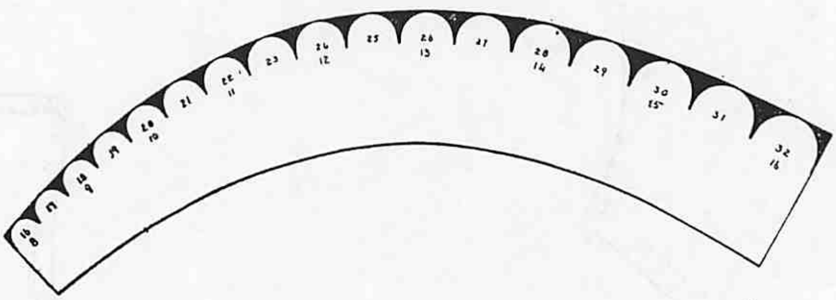
5.  5.



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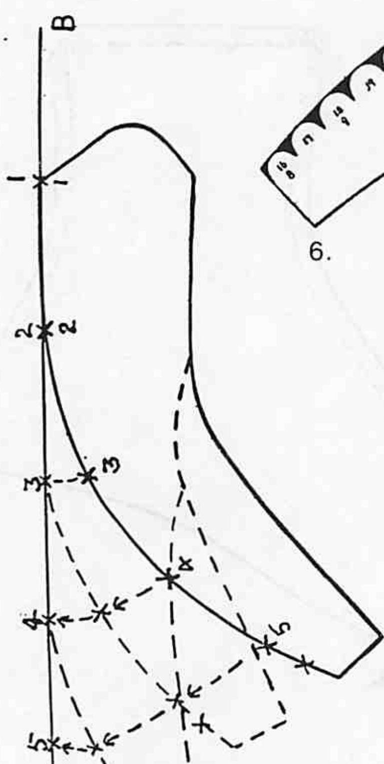

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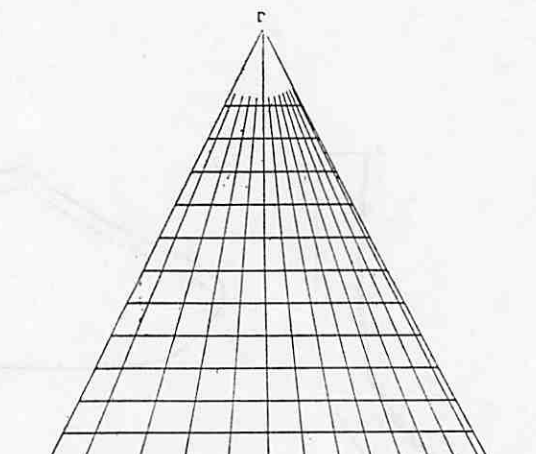

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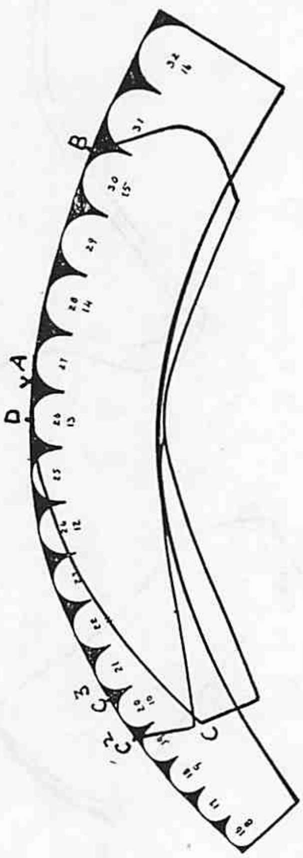

7.

Plate 26 illustrates the production of a lace boot pattern to the high leg pattern described. The height of the vamp having been decided, the length of the curve would be produced in the same way as in the shoe pattern. The method of producing the locked-in vamp has the effect shewn on Figure 1. It will be noticed the bottom corners have been trimmed off to fit in the wings. The back counter has been cut to the usual counter height, Figure 2. There is considerable latitude allowed in this, and opportunity for individual taste. The inside facing and top band, if intended for beaded or trimmed-off work, are cut as described in the men's laced boot. Figure 3 explains the method of cutting for turning down deep at the top; I J represents the actual top of the boot. If it is assumed that the turned down is equal to I M—the amount to be turned down: the paper should be folded across the top I J, and marked through at the depth required. The back and front should be cut out, and the paper then turned up. It will then be found to be of the shape I M J L. At the point M an extra 1/16th-of-an-inch should be taken off, to provide for the difference between the inside and the outside. If the facing comes under the turn down, it would terminate at the line R, as P P2. If the facing comes to the top, then the top edge of the outside should be cut back from L to l as l J. When the top has been turned, the front edge inside will be as J R. If the front edge is to be folded, 1/16th-of-an-inch should be left on down the front, as J K. The peculiar shape of the arrangement will be seen in the illustration.

Of course, if the top edge is raw, or bound, or bagged, the remarks made respecting men's work will apply in this case. The inside facing, Figure 4, does not differ in principle to that for men's work. The outline of the lining, fittings, and outside, are shewn at Figure 3. The separate leg at Figure 5, and lining pattern at Figure 6.

Plate 27 illustrates the production of the button boot. Figure 1 represents the leg pattern and the difference made between the inside and the outside quarter. A curve is cut between A B and C, which should be about half-an-inch from the front edge at the point B, coming up to the point C just below the vamp. The method of designing the button-piece is shewn on Figure 2. The dotted line represents the allowance for seams. From the point A to the point B, a piece is cut away so that B B2 equal three-eighths-of-an-inch. A B, B2 are made the same length. The width of the button-piece at the ankle should be about three-sevenths the width of the leg. Above and below that it should be cut to the individual taste of the designer, but it should not be cut too narrow at the points marked with a star. If it clears the vamp by about three-sixteenths-of-an-inch, that is sufficiently narrow. To divide the edge of the button-piece into the number of scollops required, the following method may be adopted:—Draw a line A B (Figure 3); and divide the edge of the button-piece into any given number of parts, as 1 2 3 4 5. The point marked below 5 represents the seam. To determine the length of the curve focus point 1 upon the line, place point 2 upon the same line and mark the two points found; keeping the point 2 on the line, turn point 3 on the button-piece until it touches the line, mark that point. Repeat this with each of the points and you have approximately the line length of the button-piece.

The line found may be divided into the number required by several methods. Figure 4 represents probably the most convenient way of getting these divisions. The base line A B is bisected by a line C D, and the triangle completed A B D. Along C B set off 1/12ths, 1/13ths, 1/14ths, 1/15ths, or other divisions that you may require. Along A C set off other divisions. Connect each point found with the point D; draw lines parallel with base A B, as shewn in diagram. Each one of these cross

lines will be divided into different proportions. By comparing the length found by Figure 4 with these cross lines, the division which represents the number of scollops required, can be marked off.

Figure 5 shews the method of grading the scollops. The division being found, it is compared to the scollops on the scale. The scollop which equals the division would represent the medium sized scollop to be used. The other sizes must be selected at regular distances on either side of the centre size.

Another method is illustrated by Figure 6. A grade of scollops along a curve similar to the average button-piece, and with differences representing the differences in the gouges or tools used in cutting, is set out as shewn, and used for comparing the curved edge of the button-piece as Figure 7. A greater or less number of scollops may be obtained by moving the button-piece higher or lower upon the scale. When the button-piece occupies a given number of scollops on the scale, folding over the edge as at point D will give the average size of the button-scollop required. This average may be used where only one size is desirable.

There is a practical difficulty in designing, where it is wished to produce boots with both goloshes the same height at the sides. The simplest method to do this is to measure from the centre of the edge of the waist on each side straight across the top of the last. By dividing the distance the centre point is found; this determines the instep point in relation to the waists, and would give the same depth on both sides. If the standard pattern is cut through this point there should be no difficulty. See Figure 6, Plate 23.

Assuming you have the standard pattern, measure off AB, the height of the vamp, and BC, one-and-a-half inches above it; draw lines at right angles from AB and ABC, as BI, CG; mark along CG, CE, making CE half the height of the back golosh, divide CE into four parts; at one-fourth from E as EJ, mark JI. Now lay the standard pattern with the front seam against the line AB, so that the toe is level with the point A, as Figure 6, Plate 23. Draw round the bottom of the pattern from A to G; remove the pattern; divide the distance EG into two parts.. At the length of the pattern from A towards D, measure off half EG, at right angles to AD; draw the straight line EF. Now replace the pattern against the line AB, placing one finger on the point E: turn the back of the pattern up until the counter point is upon the line EF; mark down the back of the pattern along FH, and along the bottom of the pattern GH; this produces the golosh pattern. If required for rights and lefts, the two sides must now be made to different shapes. Figure 11 shews the method. We will assume that ABC represents the first golosh produced.

Open the golosh out on the flat, the larger side will represent the side already decided; upon the opposite side lay the inner side standard pattern, so that it touches at DC, along the centre line of the vamp, cut round from C to E along the lower edge. Now placing the finger on the point I, turn the back up until the counter point is on the line of the top edge. Complete the waist portion EF. In most cases it will be found that the inside counter is required longer than the outside counter. If the whole of the difference is made at the back, separate legs will have to be cut; it is therefore generally better to cut away the curve round the front of the golosh at the point J; this produces a sharper curve at DJ, on the inner side than on the outer side, and so counterbalances the extra pull of the stuff forward on the outer side.

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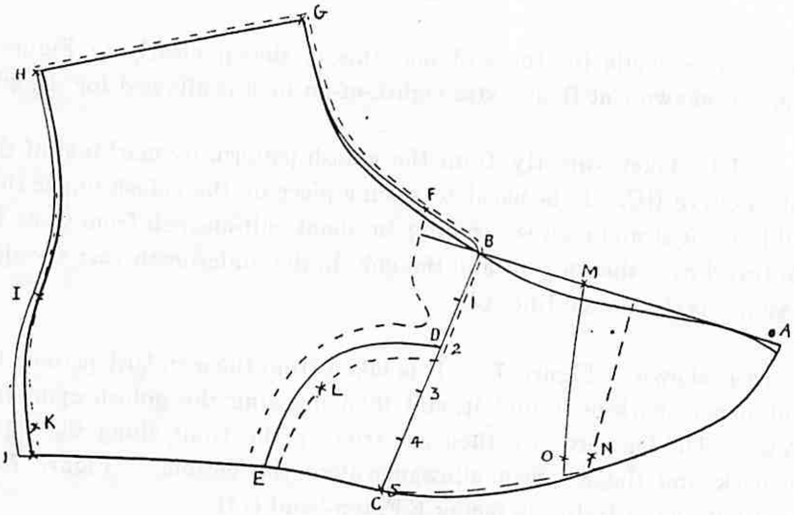
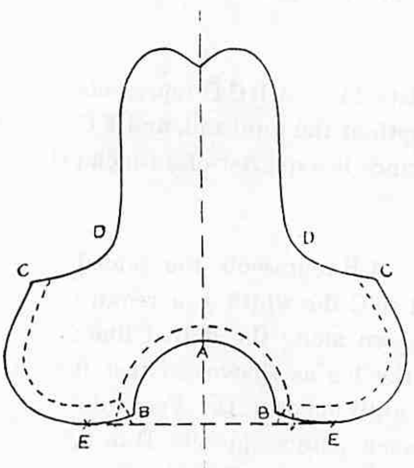
Plate 28.

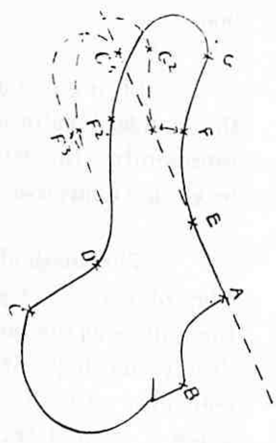


1.—Standard with Sections.

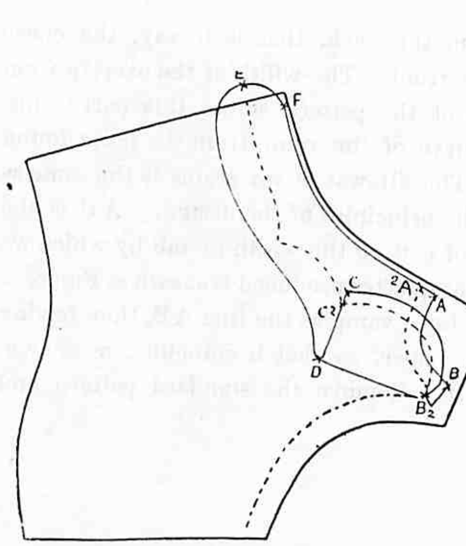


5.—Complete Tongue.

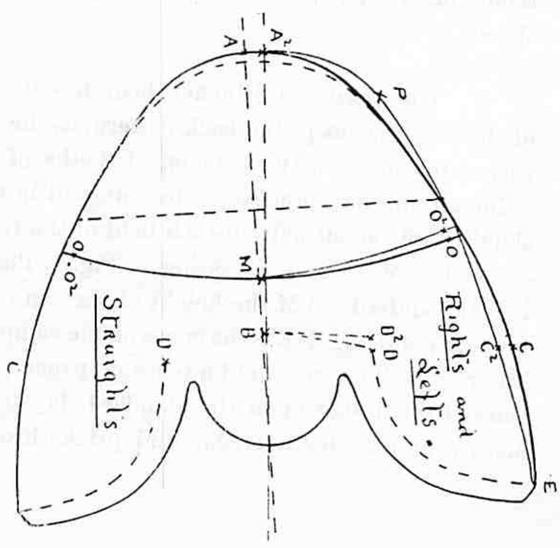
"The Derby."



4.—Developing the Tongue.



2.—Designing the Tongue.



3. Vamp—to Straights—and Rights and Lefts.

Allowances should be made for the stiffener, this is shewn clearly in Figures 2, 6. At A, the seam allowance only is shewn ; at B, an extra eighth-of-an-inch is allowed for the stiffener.

The toecap could be taken directly from the golosh pattern, by marking off the height A B, Figure 10, and cutting a curve B C. It is usual to seam a piece on the golosh under the cap, called a toe-joiner : this should be cut straight across, coming to about half-an-inch from C, as D E C. Seeing that the toecap has to travel over the toe puff and the golosh, the underneath part should be cut about a quarter-of-an-inch short, as the dotted line A E.

The leg pattern is shewn at Figure 7. It is taken from the standard pattern by placing the pattern on a sheet of paper, marking round it, and then marking the golosh upon it, as shewn at Figure 6, A B E K, A G. The leg pattern is then cut true up the front along the top, with a seam allowance down the back, and the lap seam allowance along the bottom. Figure 7 shews the leg with line of lap seam allowance A B, inside facing E F, top-band G H.

If the leg is to be bound or raw edge, or with an inserted bead, it should be cut true to the standard C I J ; if turned in or folded, allow one-sixth-of-an-inch on ; if to be with a bagged top, allow one-sixteenth-of-an-inch along the top edge. For other methods of closing see ladies' laced boots.

Lining patterns for woven materials should be cut as Figure 9, Plate 23. A B C D represents the standard pattern. First mark along the top E F representing the depth of the top-band, and F G representing the width of the side-facing. The usual lining seam allowance is a quarter-of-an-inch ; leave this quarter-of-an-inch round each of the outlines as shewn.

The method of cutting the tongue pattern is shewn at Figure 8. A B represents the folded edge of a piece of paper ; A D E F the edge of the leg. Measure from A to C the width you require the tongue at the bottom ; fold the paper up towards the top edge, as shewn along the dotted line ; decide the shape of your tongue by drawing on the leg. Now place the leg as shewn, so that it coincides with the line from A to D ; prick through the dotted points until opposite D. Focus the paper at D and turn down until the point E is on the line ; prick between points opposite D to E. Focus the point E and turn down until the point F is on the line ; prick from opposite E to F. Upon removing the leg pattern and cutting through the marks made, the tongue pattern is produced as shewn.

The Derby or Blucher boot has to be designed from the back, that is to say, the curve of the vamp is cut in the back pattern, as the back overlaps the front. The width of the overlap from corner to corner may be taken at 2/5ths of the total width of the pattern across this part ; this, although not very precise, comes out well in practice. The curve of the vamp from the point found should come about half-an-inch behind the front pitch line. The allowance for seams is the same as other class of work.—See Seams. Fig. 1, Plate 28, explains the principles of the design. A B is the height required ; A M the height of the cap ; B C the method of getting the width of tab by which we find the point D. D E is the curve of the vamp. The shape of the quarter produced is shewn at Figure 2. To produce the vamp, fold a piece of paper sufficiently large for a vamp as the line A B, then having marked the design upon the standard, lay it down upon the paper, so that it coincides, as shewn. Mark round the bottom edge and prick through the line E D. Remove the standard pattern and

cut the curve as dotted line shewn to F. FB should not be less than one-and-a-half inches. The distance between the corner of the tongue D and the front line should not be less than half-an-inch.

In all blucher-fronted work there is a common defect on the inner corner of the tab, owing to the extra prominence of the last at this point. If the last has been measured as previously described the amount of extra line length at this part will be known. This should be left on at the corner of the tab, as Figure 3, D D2. This will make apparently different shaped patterns for each side, but the difference in the shape is rectified in the boot or shoe by the extra curvature of the last.

It will be noticed that the centre line of the vamp A, Figure 3, has been deflected to A2 ; this is for the purpose of providing for the turn of the toe at the end of the last. If two standard patterns—one for each side of the last—are made to coincide between the instep point and the joint point, the difference between the spring of each toe will be seen. For the purpose of getting the same amount of foul stuff upon each side of the toe, half this difference in spring should be allowed towards the inner side, as A A2. The other parts of the lower part of the curve do not need further explanation. The tongue pattern is similar in its construction to that for an open tab ; the method of developing it is shewn at Figure 4. The quarter pattern, Figure 2, with the inside facing stitching marked upon it, B2 C2, is laid upon a folded piece of paper, as Figure 4. Points are marked up the fronts, as AEFG, and the points focused and turned down as previously described producing A G3 F C B.

This tongue may be cut in profile—that is to say, on the flat and then developed ; Figure 2 shews the method. A piece of paper is laid under the quarter pattern and pricked through where the vamp comes to, as A B, and cut true to shape, as A F. From the point B2 level with the front edge, the paper should then be turned up, as B2 D. The markings of the facings should then be pricked right through. The paper can now be removed, and the curve of the facing cut out from C to B2, and the curve of the back part of the tongue cut as C D E F ; this completes the profile of the tongue. To develop it as a solid tongue, mark its front as AEFG, place the edge A E upon a folded piece of paper and mark round A B C D ; keeping the point E in its place, turn F down to the folded paper, mark D F2 ; keeping F in its place, turn G down to the folded edge of the paper, mark F G to G3. This completes the tongue as Figure 4.

The open-tab golosh boot, or as it is sometimes called, the blucher-fronted golosh boot, is one of the most difficult designs to cut. Perhaps the important point to remember is, that the whole of the parts meet and cross at a point which is at the inner corner of the tab ; if this is kept carefully in mind and provision made for it, the difficulties are not so very great. Most golosh work can be cut so that the back counters fit into the opening between them without much difficulty ; but this type of boot, if cut in that manner, is very likely to produce a bad pattern, except in the very narrow fittings ; it is much better to decide a width of tab and to design the boot round that. We will assume that the standard pattern is as Figure 1, Plate 29. The lasting allowance is shewn at A ; the actual height required in the finished vamp as AB ; the width of the tab may be as BC, *i.e.*, 2/5ths of the length of BG ; the height of the back counter is shewn at D ; the length of the overlap side seam is shewn at C E—in this case it is assumed to be one inch. The termination of the stitching of the facing is shewn at the point F. The line ED is generally taken from a point 3/16ths above the line CE. We will assume this amount for our purpose. To produce the golosh pattern, fold a piece of paper sufficiently large, as along the line ABD, Figure 2. From the point A to B mark the total height of the vamp ; from B to BE mark one-and-a-half inches. Place the standard pattern

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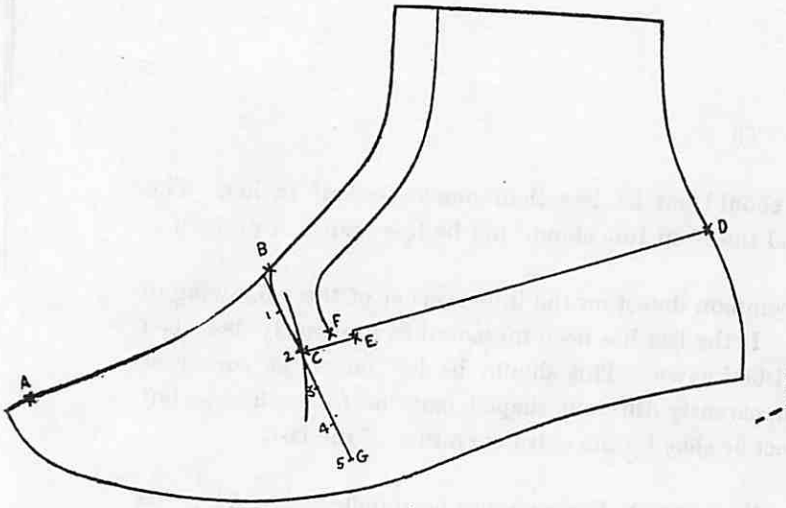
Plate 29.



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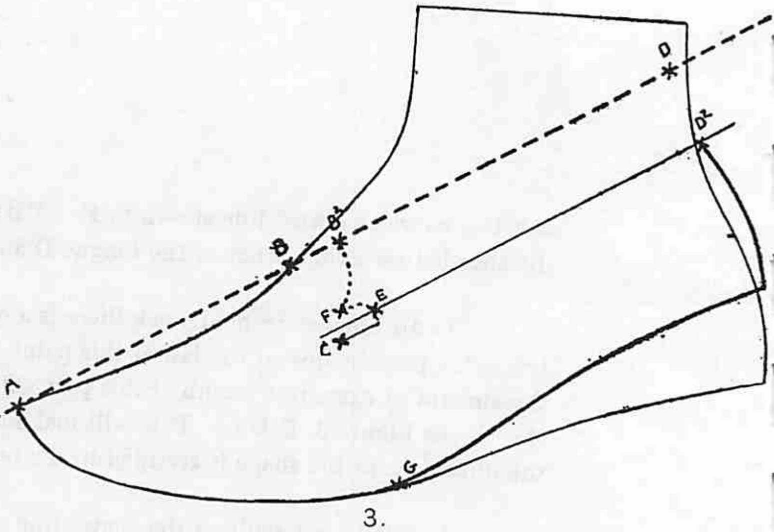

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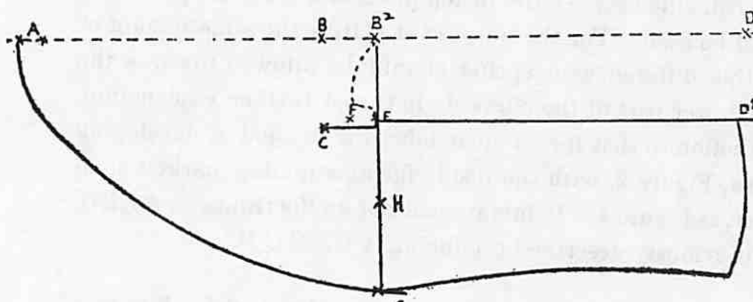

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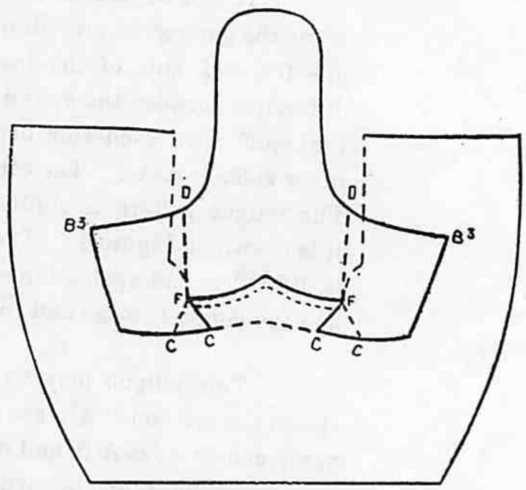

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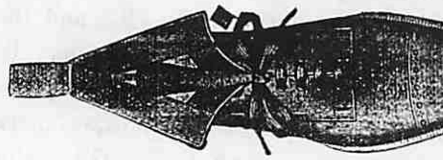

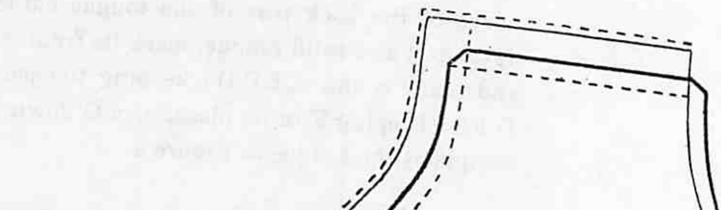

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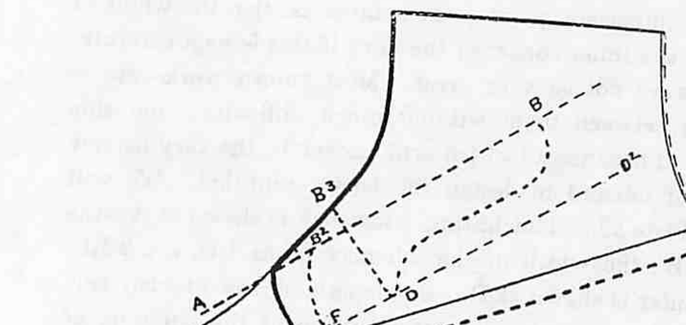

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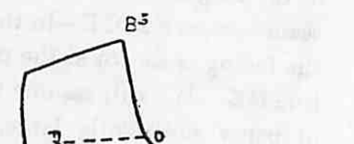

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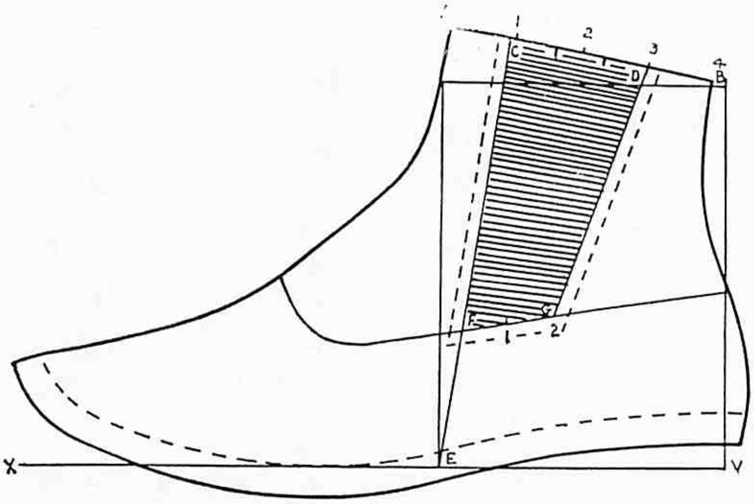
Plate 30.



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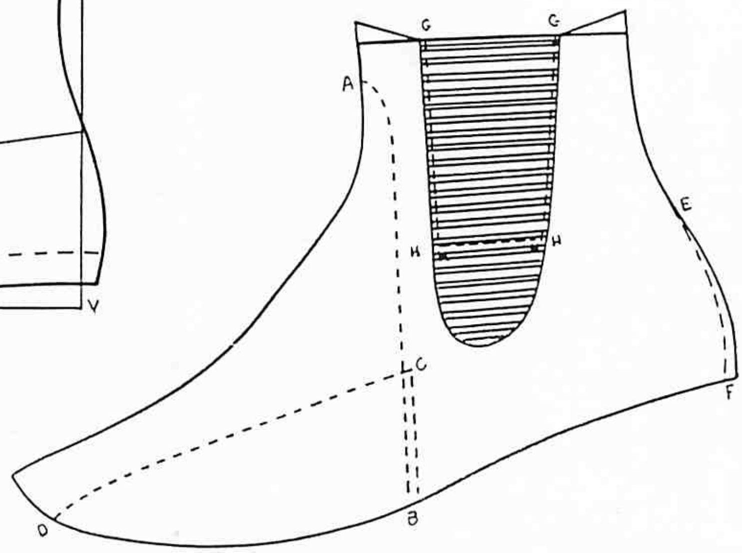

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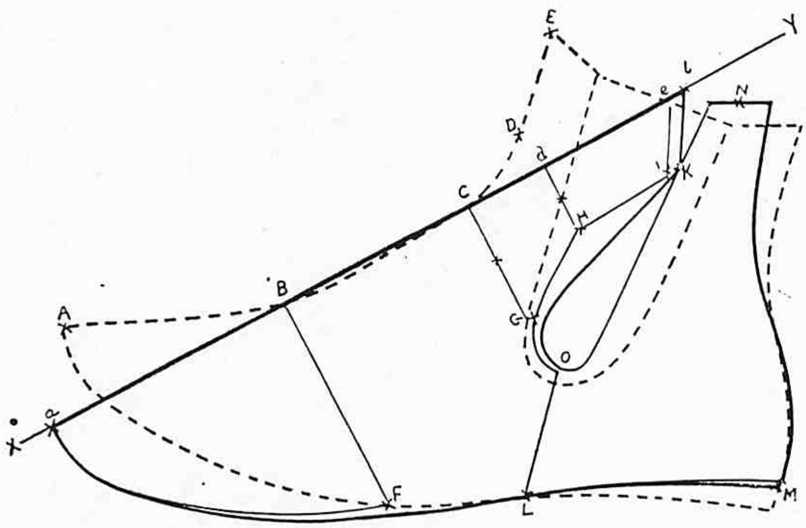

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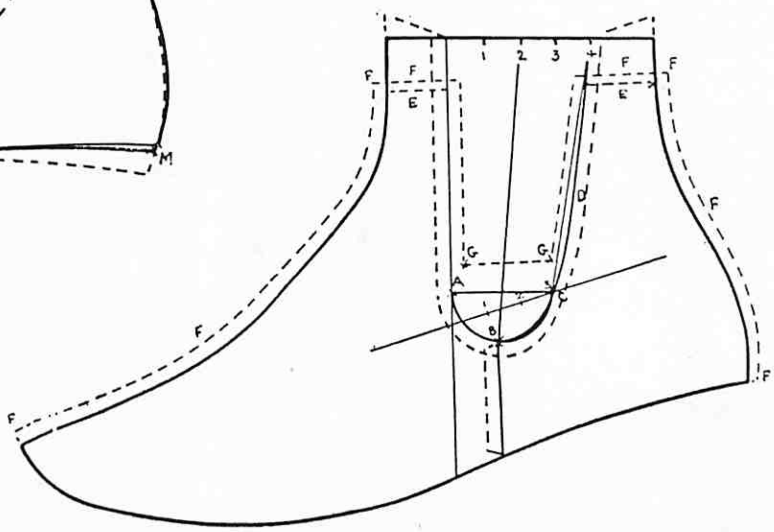


2.

upon AB, as shewn, Fig. 3, then from D towards D2 mark half EG, place an awl through the point C; raise the standard pattern until the point D is opposite E D2; complete the bottom curve D2 to G, prick through the point F; now remove the standard pattern; cut a curve from F to B2, and from F to E; this completes the golosh pattern. An alternate method of cutting the curve is shewn at Figure 2. This also represents the method of cutting the goloshes to lock in. In this case the bottom line AG is first marked from the standard, as explained. The distance B2 E is then marked equal to half the height of the golosh at the back. The length of the standard pattern is then marked from A to D, and D2 marked at half EG as GH, therefore D2 equals GH. A line is drawn from E to D2, the point C is then found by drawing a line 3/16ths-of-an-inch below E D2, and an inch long as EC. To determine the bottom curve and the back, the standard pattern is replaced on the top of the golosh so that it touches at ABG; it is then focussed at the point C, and turned up until the counter point is on the line D2 and the curve G D2 completed. The leg pattern is shewn upon Figure 5. The solid edge from F towards the top is cut true to the pattern, or an allowance is made as before described. The dotted lines represent the seams.

The inside facing is cut as shewn, Figures 1, 4, and should now be marked upon the standard pattern. If it is to be cut with a top band, that also should be marked. Figure 4 represents the relation between the standard and the lining pattern. The thin line represents the standard; the dotted line represents the top-band and inside facing patterns, by which it will be seen that the inside facing pattern is cut from the corner F down towards the lower edge of the tab. The usual allowances are made for trimming off, &c. The lining pattern is shewn in a thick line. There is the usual allowance for seam along the top-band and down the edge of the facing; this is brought down to a corner at the edge of the tab. The golosh pattern is laid upon the lining, with its corner against the point F, and marked round. The front seam allowed in a straight line down the front, and cut true to shape from the point F up the tongue. The result in shape is seen by the diagram. It will be noticed that the heel seam is cut off close, this assists in producing a clean inside lining.

The method of producing the loose tongue is shewn at Figures 5, 6. Figure 5 shews by a line AB the folded edge of a piece of paper: it is laid so that it is level with the front of the vamp, the vamp is laid upon it and marked from F to B2, the paper is then turned up as C F D D2, and the leg then laid upon it in a corresponding position, carefully getting the point F in its correct place. Next mark C B3. Now remove the pattern and measure the distance required for the height of the tongue as B2 B, and cut as the dotted line BD, D B3. When this is opened it will have the appearance of Figure 7, and can be inserted into the front of the vamp, as shewn. When the paper or leather is turned up to fit the facing through the point FD, C will turn to c; B3 will go up to the instep.

Some people prefer to have the tongue straight across underneath, this may be arranged by cutting it as Figure 6. FCA represent the shape of the bottom, but FC should be cut at such an angle that C B3 represent either the shape of the leg or of the inside facings. It is rather preferable to have the tongue to form the inside facing at the lower part of the facing.

The elastic side, or the Congress boot, makes excellent footwear when properly cut, but the popularity of th[e] style has been lowered by the bad cutting. It is not a difficult boot to design, many of the constru[cti]on lines previously described can be utilised in cutting this pattern. Figure 1, Plate 30, represents the principle of determining the position of the relative parts. XY is the ground

line; the pitch line and ankle line are made exactly as in a lace boot; it should be pitched rather forward as shewn at B. The line A B may be sloped to suit the designer, but should be divided into four parts, as 1, 2, 3, 4; an eighth-of-an-inch should be taken from A 1 as A C, leaving C D for the width of the gore at the top; connect C to the lower part of the front pitch line as C E; divide C D into three parts; mark two of these parts along the counter line previously made from the line C E as F G; connect G D; C D, F G represent the shape of the gore. The allowances are the same as all other work, and are shewn in dotted lines. The additional construction required for this work, if cut without a counter, is shewn at Figure 2. The counter line is drawn as shewn; the top of the gore is divided into four parts; a line A C is drawn at right angles to the pitch line; three parts of the top of the gore are measured across it. The lower part of the gore may be cut as a half-circle, but it is preferable to make a bolder curve as B C, and to carry the curve away from the straight back line as B C D4. If it is linen lined with a top-band, the lining is cut as shewn by the dotted lines F F F; the top-band comes down to the lining as E. It is usual to leave the lining solid across the lower part of the gore G, and to cut it away after the boot is made. If the back is lined with leather, but the front unlined, the section is as Figure 3. The leather lining is represented by A B, E F; the amount taken at E F being for the stiffening; B C D represents the side-lining; H represents the solid part of the leather lining which is cut away after making.

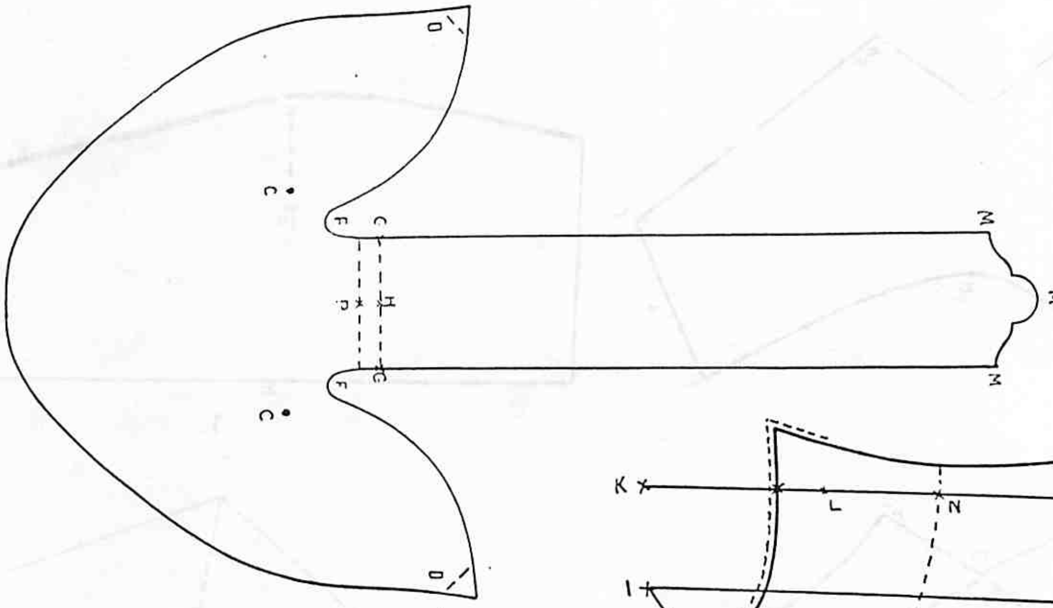
The method of producing the "Castor" pattern is shewn at Figure 4. The outline of the pattern is marked as A B C D E F G. X Y represents the folded edge of a piece of paper. Place the points B C on the folded edge; mark F L, G O; put the awl half-way across B F, turn the point A down to the folded edge and mark A F; return B C to the original position; put the awl half-way across C G; turn D to d, and mark G H; put the awl half-way between D H, and turn E to e, and mark H K E. Now focus the pattern on the point O, turning it up until K touches the outline mark, as shewn; mark L M N K O; this completes the casting pattern.

Plates 31 and 32 illustrate the cutting of very heavy work. Figure 1 is the profile of a heavy boot made with a watertight tongue. The allowance for this class of pattern over the actual line length of the last is usually two inches. The back of the leg G H J should be cut according to its height, it should just touch the back of the outline at the ball of the heel and the back of the leg above the ankle. Seeing that the back line is straight, any difference between the leg and the ankle measure has to be made in the front part of the pattern; it therefore takes the appearance of Figures 1, 2, Plate 31, according to its height in cut. The height A B for the front, being first marked off, and the curvature B C, allowance C D, and the curve D E, being decided, the next operation is to determine the size of the watertight tongue. First mark off the size of the heel measure F G, then the ankle point H, and the point about two inches above it J; draw H I J K level with the base; make H I equal F G; mark L M the width of the facing from the front edge; draw I O in the direction shewn. The tongue has to be cut so that the amount of material behind the points L M, equal the distance L K, I M. The lower part of the tongue is cut upon the same principle as the Derby tongue previously described. The appearance of the whole loose tongue is shewn at Figure 3.

A bellows tongue may be cut to fit without blocking by the method shewn on Plate 32. The width across the vamp and the throat of the pattern, and the top, being determined and measured as Figure 1. A point across the throat is marked as E H, and cut through. J H is the folded edge of the paper or the leather. It is then put into the machine and blocked, resulting in the shape as

Plate 31.

4.



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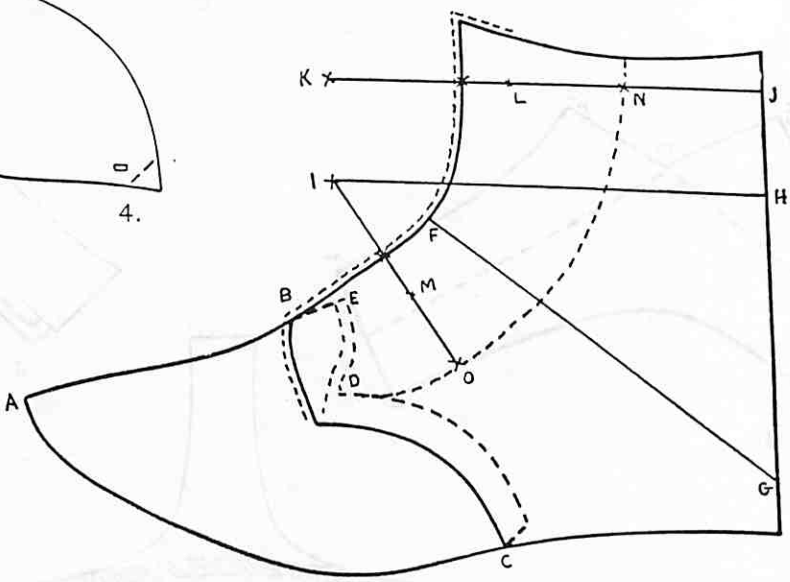

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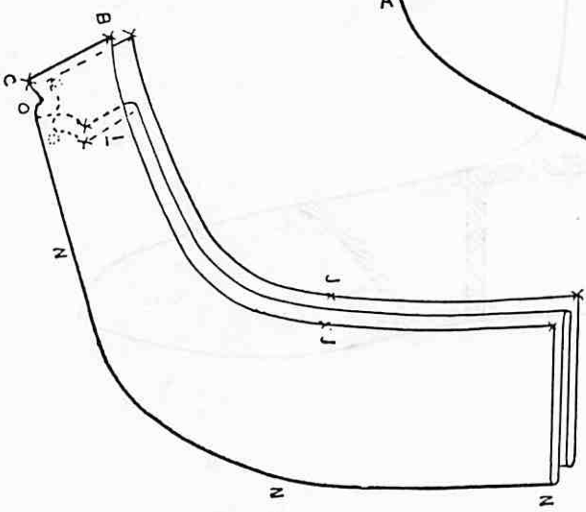

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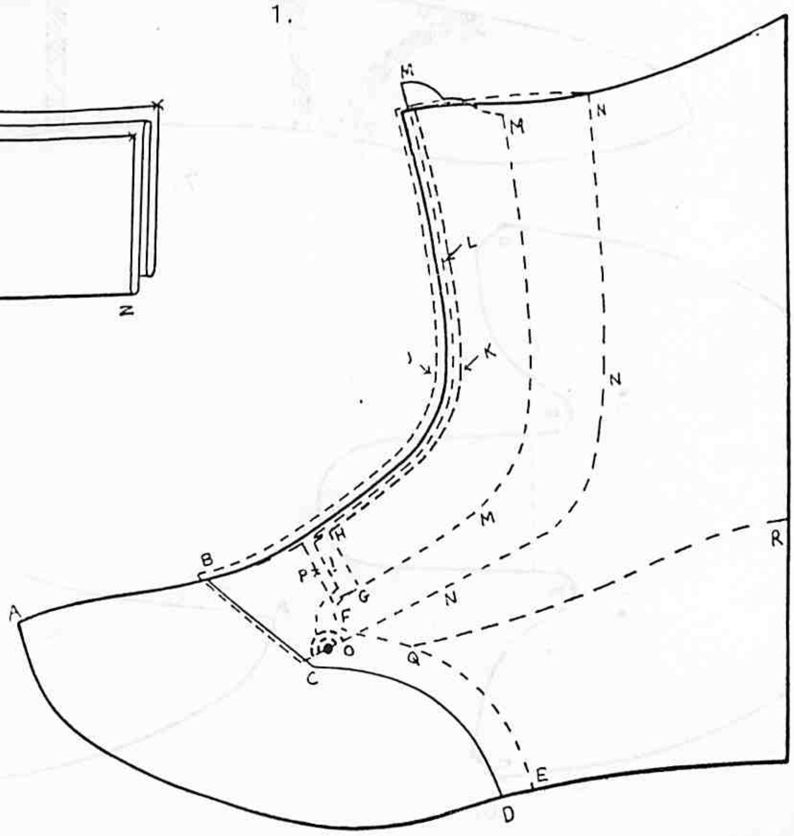

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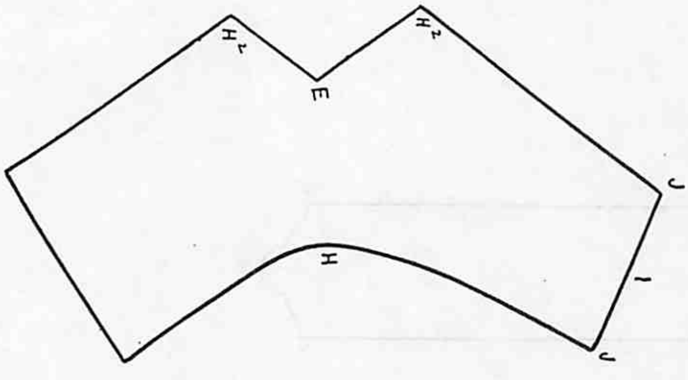
Plate 32.



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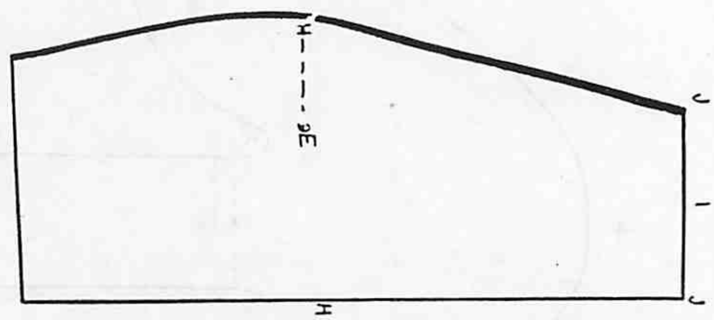

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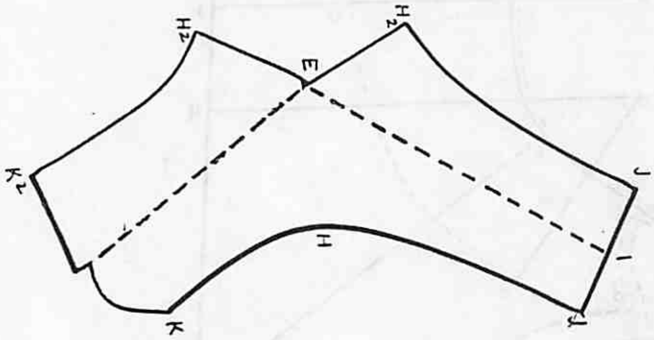

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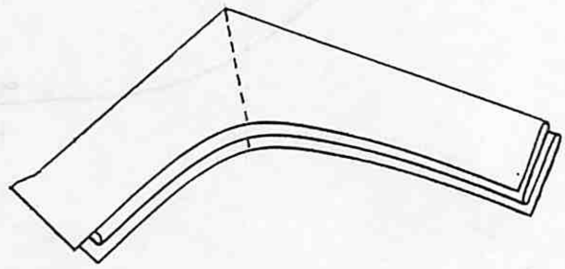

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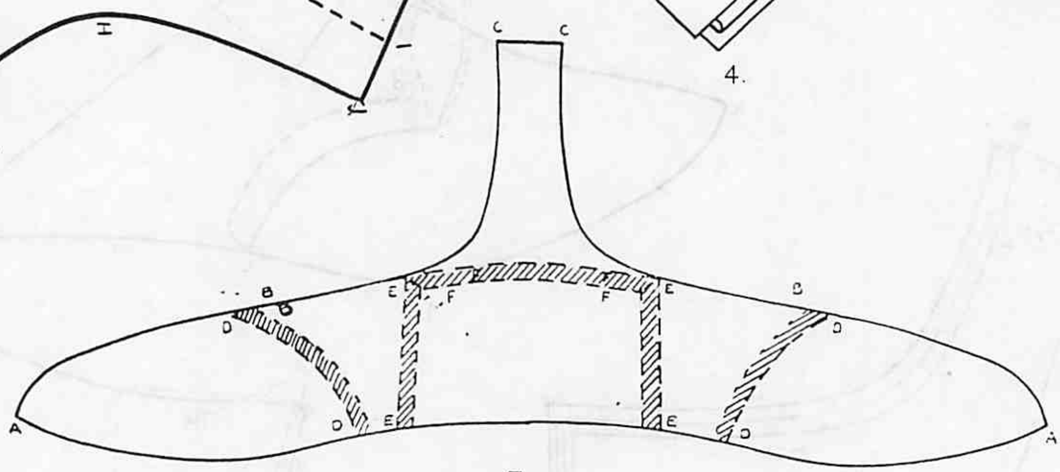

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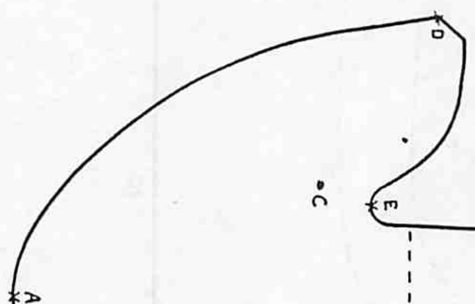

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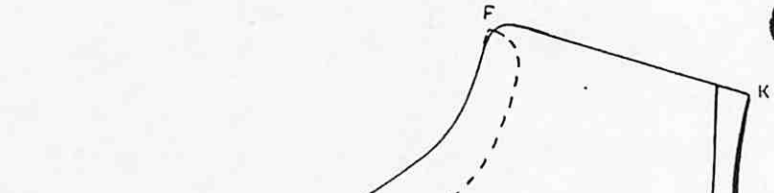


5.

Figure 2. This being folded down the line E I, and cut out true to the front edge, and where the overlapping pieces E H2 cross, produces the shape as shewn. The seam H2 E is then made by machine: this then produces a tongue which fits straight into the boot, as Figure 4.

The principal defect of bellows or watertight tongues is that, when blocked down the front edge, the facing edge of the tongue has too much line length, and consequently, the stitcher has to pleat it in when seaming it.

The usual method of cutting a Blucher is shewn at Figures 5 and 6, Plate 32. A B represents the height of the vamp: A C, the corner of the lap; C D, the side curve. In some classes of work, the tongue E F is cut solid with the vamp, this is preferably blocked as A B C D E F. This class of boot often has an outside counter as I J K L. The portion I J L should be left very full beyond the outline of the back to take the stiffening shewn by the darkened portion. Figure 6 shews the shape of the vamp when on the flat. The points E should not be more than one inch or less than half-an-inch from the point C. The dotted line represents the position of the seam usually made where the tongue F is cut distinct from the vamp. In some cases this work has inside fittings, the outside being left quite plain. Figure 7 represents the shape of the fitting. A B C is the top curve of side lining, counter and back strap. These may be joined in several ways; the back strap may be cut as C E, E E, the lap seam being shewn at F. The counter may be cut from D to D, joining the back strap at E. In some cases the back straps come to the bottom, and the counter is cut as a very short piece as E D. This would leave the side lining as A D. In other cases the side lining is cut to come back to the seam E E, as A E E. Generally, a combination of each of these is made in a set, so that scraps of all sizes may be used up. The method of cutting a heavy boot with extra loose tongue is shewn at Figure 2, Plate 31. The points C F have already been explained. H G P is a lap seam of the tongue M. This tongue should reach the top of the boot: it may be cut in a fancy curve, as shewn, or cut in long strips like laces. There are some peculiar fashions in this class of trade. The shape of the tongue when ready for fitting, is shewn at Figure 4: the complete pattern at Figure 2. The student can trace the position of each part from the lettering. It will be noticed that the back counter Q R is carried round the boot without any back strap.

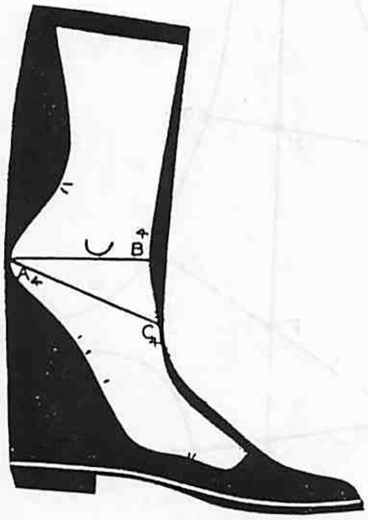
Long boots are generally defined as work which comes to the calf line, and in most cases without any special arrangement down the front to permit of the foot passing into the boot; this makes it necessary that all parts of the boot through which the foot passes shall be equal to the largest dimension of the foot. To determine this actual dimension, the positions taken by the foot as it passes into the boot are necessary. The most prominent parts of the foot are the instep point, the ball of the heel, and the throat point—A B C. It will be evident that if we draw a line from the heel to throat and consider that as a horizontal line, that the relative space occupied by the point C, in the rectangle A B C D, will be determined by how far the person can thrust the point C below the point B. Assuming that to be about one-inch-and-a-quarter, if we provide for the line A C between two parallel lines one-and-a-quarter-inches apart, it will provide for the passage of the foot into the boot. The actual progress of the foot into the boot is shewn by the diagram. The application of this principle is shewn upon Plate 33. The line A B represents the ground line; the point C is made at half the length of the last from the point B; C D represents the front of the leg of the boot; E is the height of the calf; D F the girth of the top of the leg; E G that of the calf; H is the instep point: H I a line parallel with the ground line one inch over the heel measure; J is a line from the centre of the throat parallel with H I; K is one-and-a-quarter-inches above it; K L is parallel with J: M is one

inch above K L and parallel to it. This produces the points 1, 2, 3, upon a vertical line from B. If lines are now drawn from J towards line 2, and made one inch over the heel measure, it will produce the point K. If a line is drawn from L towards the line 3 and made one inch over the heel measure it produces point M. A curve cut through F G M J I B produces the back curve of the boot.

If the boot is intended to have a jockey top, the original standard has a line marked one inch below its top, as Figure 2, Plate 33. A piece of paper is folded down its edge, Figure 3, as A B, and folded down at the top edge along the line C. The standard pattern is then placed against the folded paper with the top corner against the point E. With the front edge drawn back one-eighth-of an-inch as 'a,' prick along the standard one inch below the top edge as 'a d.' Cut the back of the paper out to the shape of the standard pattern leaving on a quarter-of-an-inch; mark the back curve E half-an-inch below the top of the standard; now remove the standard and open the paper. At one inch above the edge of the fold as A D, measure off the exact width of the top of the leg of the standard as A D—cut this in a straight line. Cut E D in a straight line allowing one-eighth-of-an-inch E. for seam. When A D is turned down to 'a d,' A D will fit the top of the leg of the boot, while the outer side of the top will be sufficiently large to go over the boot. The aperture at E is covered with a short strap, another rather longer strap is stitched on the outer side, as shewn in the illustration of the finished boot; this outer strap is stitched at the bottom for a servant's boot, but left loose for a gentleman's.

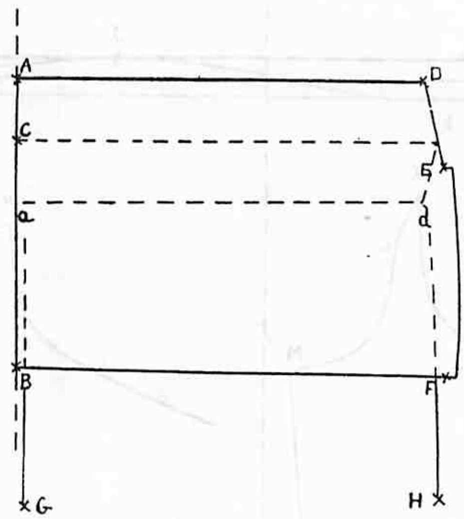
The jack boot does not differ in the essential principles of the cutting, but it is cut without a loose top and always has a butcher tongue. The hunting or jockey boot may have the special tongue which takes its name from it (see Plate 2). The jack boot is sometimes cut with a curve at the top of the leg, to permit the boot being cut the utmost possible height; this method of cutting is shewn at Figure 1, Plate 34. H H is the average height of the boot. I upon the inner side of the leg, at three-fifths from the centre line of the boot, is made a quarter-of-an-inch below the line H H; J upon the outer side of the leg, at one-third from the middle line, is made a quarter-of-an-inch above the line H H. The line H I J H is then cut; this produces a low curve on the inside of the knee joint, and a high curve on the outer side of the calf corresponding to the difference of the shape of the leg inside. The curve is not noticeable in the boot, but greatly adds to its appearance on the leg.

Diagram No. 2, Plate 34, shews the usual differences made between the different parts of long work. A represents the back line of the original standard pattern; B B the allowance for substance; C D the allowance for stiffening. It will be observed that the back curve of the finished boot with the allowances are very different from the back curve of the original standard pattern. E F is the side seam of the outside counter. It is usually made to coincide with the line H I, Figure 2, Plate 33. The distance from A to E should equal the distance from the centre of the seat of the last to the position of the corner of the heel. F G is the curve of the throat. This curve shews a butcher tongue. H is the point of the back counter where it meets the back strap—usually about half-an-inch wide. I J, I K, represent the form in which the lining might be cut; if cut to I J, the side lining from M is seamed as J P; if cut from K, the side lining would be carried along the dotted line, as shewn. I L represents the seam under the curve of the tongue. The point L should come at the lowest point in the front line of the leg. Where there is a lined front, the opening for the lining should be cut as L Q. The shape of the outside leg is shewn at Figure 1, Plate 34; the shape of the lining at Figure 1, Plate 35. The shape of the front lining is shewn as A B; the shape of the complete front as



1.

The "Jack" Boot.



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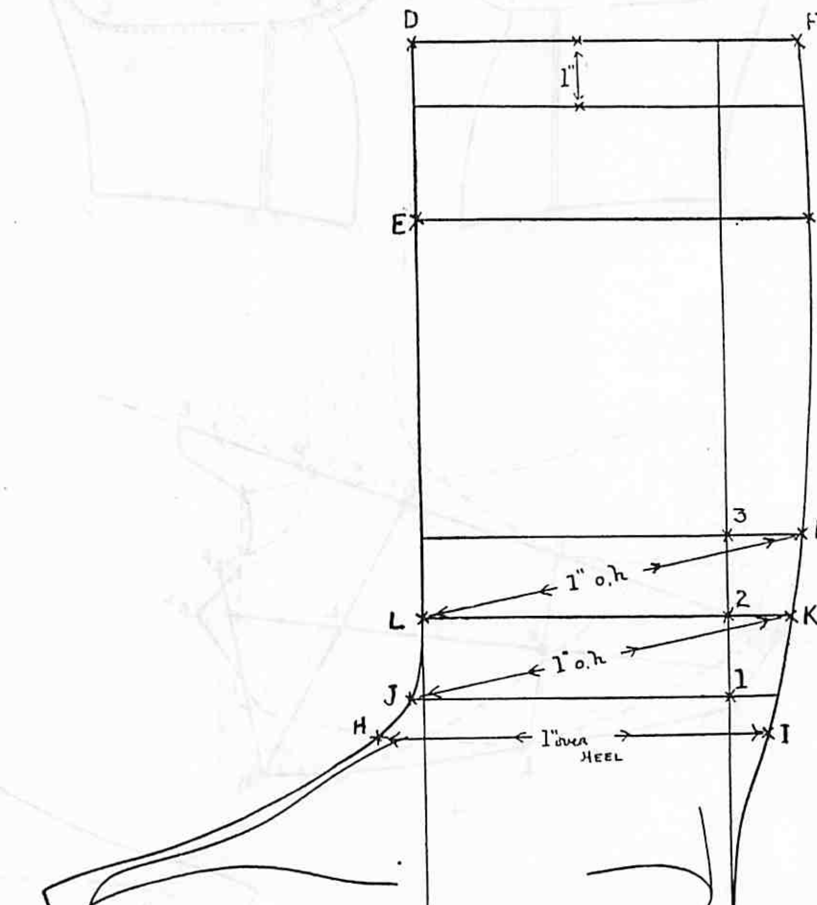

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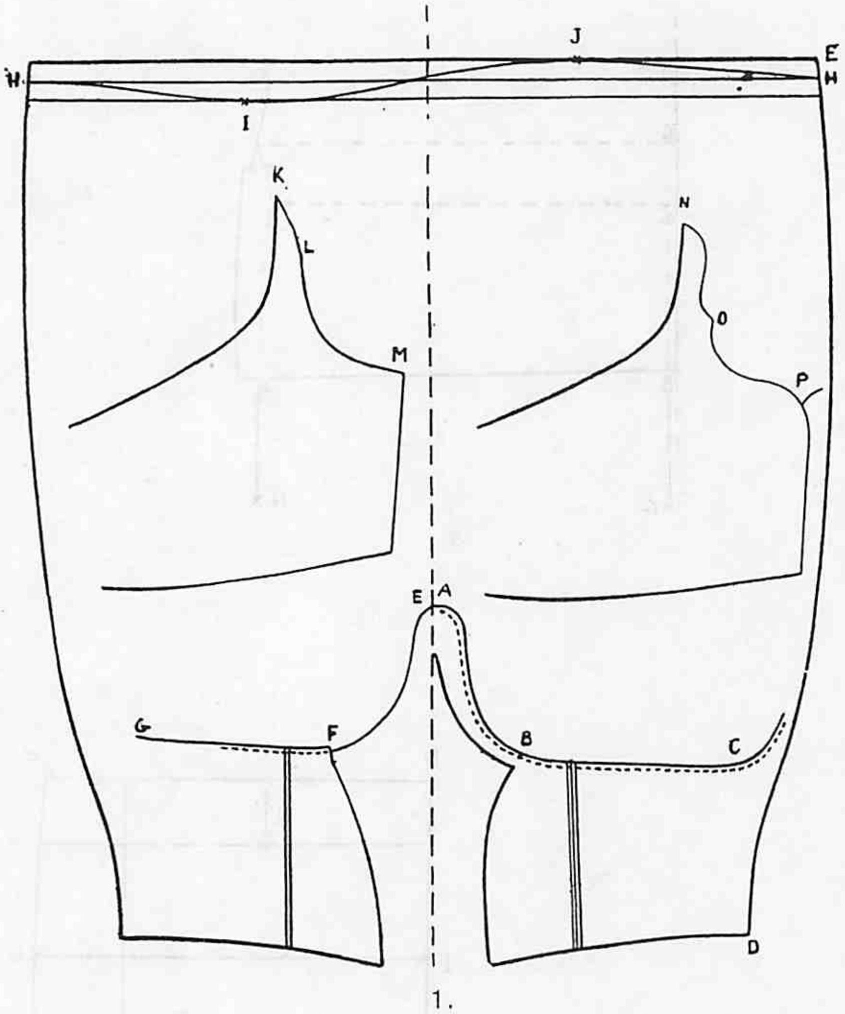
To face Page 61.

Plate 34.



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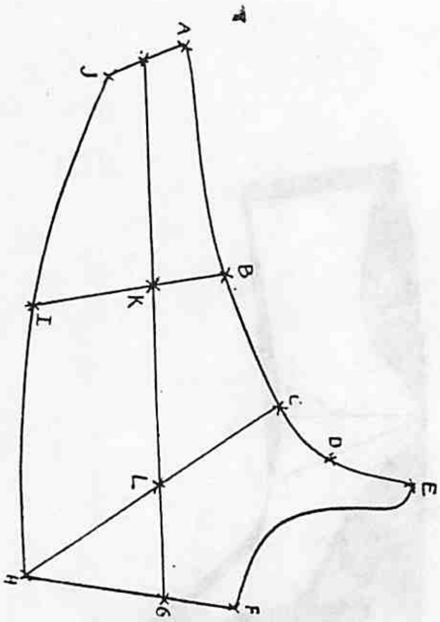

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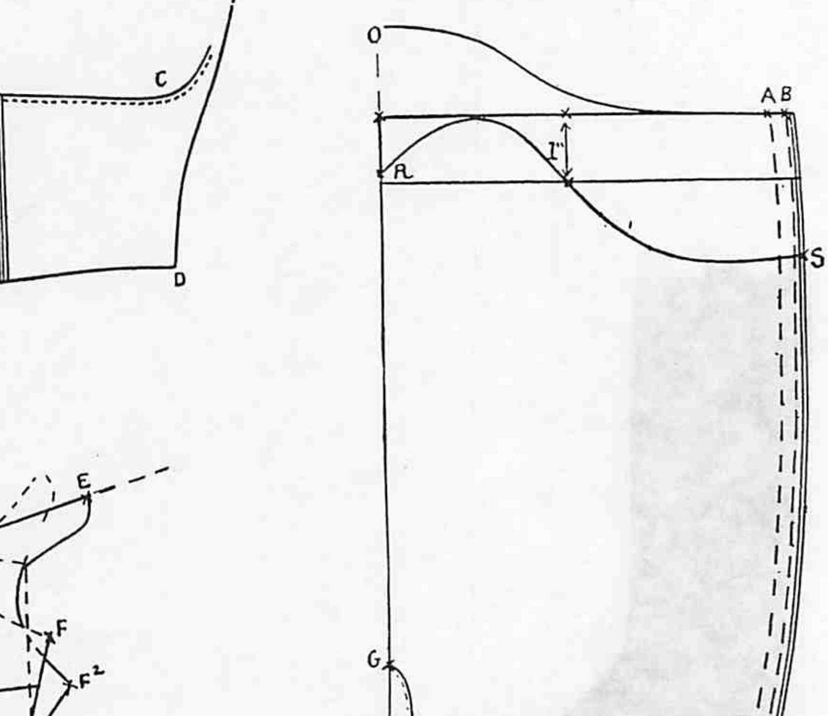

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4.

A B2 ; A fancy butcher tongue is shewn as NOP ; the jockey tongue as KLM. AB Figure 1 explains the method in which the butcher tongue is stitched on ; GFE shews the way in which a butcher tongue is closed in with a flat seam ; the line EF being cut true to the shape of the tongue. Assuming Figure 3, Plate 34, to be the shape of the front cut from the standard, the method of producing the casting pattern would be as follows :—

Mark points up the front ABCDE ; divide FGH into three parts ; divide AJ into two parts. From the centre of AJ to one-third of FH as G, draw the line KL ; draw lines BI, CH, producing K and L. Fold a piece of paper of sufficient size as ABCDE, Figure 4, Plate 35, and place the front pattern so that the AB is against the folded edge of the paper ; mark AB, AJ, JI, put an awl through the point K, turn the front down until the point C is on the folded edge and mark IH, HF ; put the awl through the point L, and turn down until the point D is on the folded edge, mark F2 ; turn the front down until the point E is on the folded edge, mark EF. This will produce points as shewn. Construct the casting pattern round these points.

Another type of jack boot is shewn with a curve RS, Figure 2, Plate 34. It is used for military purposes, cut at various heights. The point O represents the front of a Napoleon boot, it should come about the centre of the knee-cap ; the end of the curve OAB should come just below the bend of the knee at the back.

Field boots, *i.e.*, boots that are cut with an opening for the foot to pass through, may be cut upon the principle illustrated Figure 2, Plate 35. AB is the ordinary ground line ; ACDEFG a line at right angles to it ; AH is half the length of the last ; JI parallel to AG ; C is the height of the heel above AB ; D the height of the counter ; E the height of the ankle ; F the height of the calf ; G the height of the leg ; EJ is the ankle line ; K, one-and-a-quarter inches above it ; K2, one-and-a-quarter inches from K ; Draw KL, K2, and K2, L2, parallel to EJ ; measure off from the front line along G, the size of the top of the leg ; from the point I along F, the calf. Cut the curve down the back, passing through EDC, and through L L2 to the leg. The curve below D is taken from the forme as is the front of the pattern ; along the line EJ from E, measure off not less than half-an-inch over half the ankle girth. Complete the front curve, as shewn.

The position of the opening will be decided by the shape of the leg and the relative size of the heel of the foot. If the line JL represents the heel measure, it is quite certain it could not pass through the ankle of the boot. Therefore, the length JL must be found higher up, and the front point with which it coincides will be the position of the opening.

Figure 1, Plate 36, illustrates the shape of the outside leg. AB represents the top of the leg ; this may be cut upon the principle of the jack boot, as explained. Inspect the downward curve BC, and the upward curve BD. This curve should always be cut in a field boot. At one-third the distance AB as E, cut EF down to the calf line ; take out a piece 3/8ths-of-an-inch wide at E, as shewn ; this will cause a draft in the top edge of the boot.

It is much preferable that the leg be cut rights and lefts. The outer side which has the draft EF, should have 1/8th-of-an-inch left on at the point A, and at the point B, as shewn ; and a corresponding amount taken off the inside leg. This will produce a perfect fitting front and back seam, and a draft in the leg, that will set well over the swell of the calf.

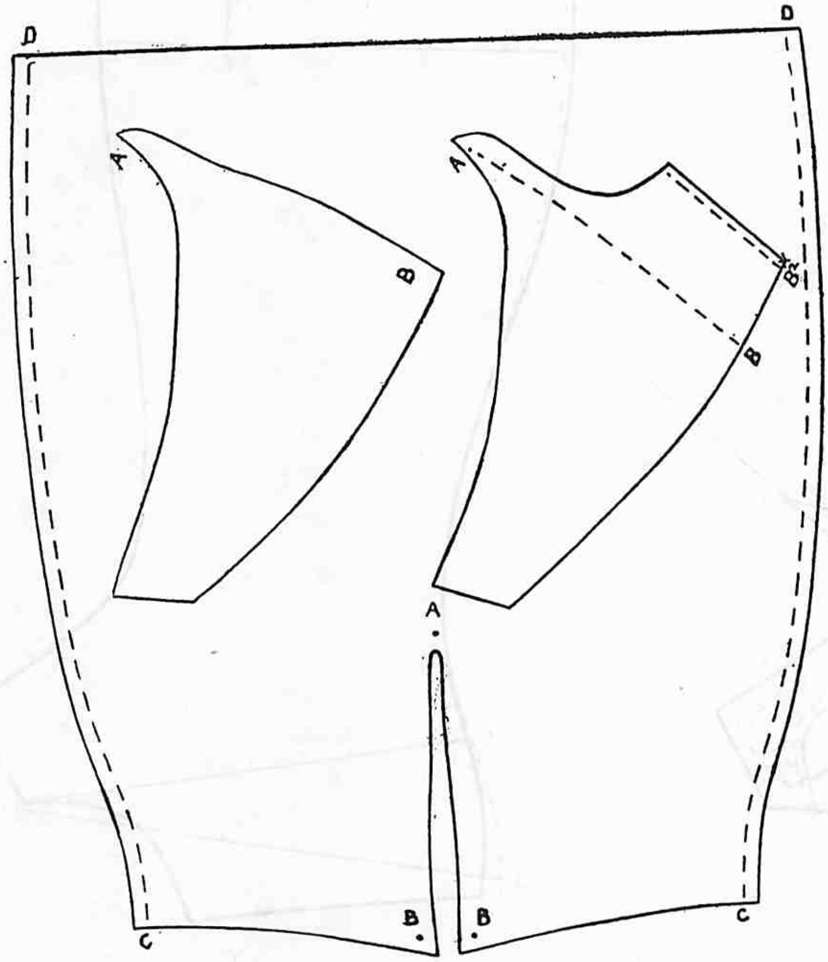
The vamp portion of this boot does not differ from a Derby. The cutting of the lower part of the tongue is also the same. In most cases, boots made on lasts with full inside joints, should have 1/8th-of-an-inch left on the point H, to go over the swell of the last, as G H. The curve I J represents the allowance for stiffening. Figure 2 explains the method in determining the size of the tongue. G H is the ankle line ; this should be made equal to the heel line from from G to H. H E is the heel line. The point H shewing the amount of room required by the foot passing into the boot. E2 H2 equals H H2, and represents the width of the tongue required at that part. A B is the edge of the facing. I J is the width of the lower part of the front back strap. These measurements determine the cut of the tongue.

Wellington boots are distinguished from other long work by having the seams down the side instead of the back or the front. The essential principles by which the space is secured to allow the foot to pass into the boot, are the same as for all other long work. The line A B represents the ground line which should be made about four inches longer than the last ; at about the centre of the line make a line at right angles to it as C D, which represents the height of the heel the boot is to have ; continue C D for about twelve or fourteen inches ; mark D E the height of the counter ; D F the height of the ankle ; F G, one-and-a-quarter inches ; D H the height of the calf ; D I the height of the leg ; draw lines at right angles to each one of these points ; measure I J the width of the calf, and H K the same width ; draw the line K L down towards the ground line, measure back from D towards L, half the length of the last, draw the upright line M N cutting the counter line. From L towards R, and O towards P, mark off the length of the counter required—this will be about three-and-a-half inches for size 7's ; about 1/8th-of-an-inch difference between size and size ; mark from P and R towards D and E, an amount equal to L M, N O ; halve the difference P Q, R S, and draw a line through the points straight up the leg as U V X Y. From point F towards the line G, measure off the long heel measure ; at the point Y mark off the difference between the girth of the calf and the girth of the top ; make the point V two inches below the calf line, and X one-and-a-half inches below the top, now place the forme upon the ground line, with the back against the line M N, and the bottom resting on the line M D, mark down the front and note the instep point E2 ; draw the line E2 N2 straight back, make it equal to the long heel measure ; the distance between the back line and N2 should be left in the centre, as shown ; the distance between G2 and T should be left at U, as shewn. A curve may now be cut as represented on the diagram by R P, U V X Y, S Q U V X Y ; this may be done, if preferred, by folding the paper down the centre line U Y ; the two curves may then both be cut together. When cut out, they present the appearance as Figure 2 ; if cut with an outside counter, the counter should be drafted out at E ; if cut with an inside counter, an allowance of quite a quarter-of-an-inch must be made at F as the dotted line. The line E F is preferably cut straight.

The butcher front and counter are similar to that described for a jack boot ; the top lining is shewn in dotted lines J K L M ; the curvature of the leg is cut at the back K L. If the front is to be blocked, mark the front—Plate 36, A B E G J M L. A B represents a line of folded paper. Place the leg as A B against the folded edge, mark A B A C D ; place an awl half-way between B D, and turn the point E down to the folded paper, mark D F ; place an awl about two inches behind the point E, and turn the point G down to the folded paper, mark the point F H, H I ; place the awl about one inch behind the point G, and turn the point J down to the folded paper, mark the line I L M. Now leave on as R S, about one-third-of-an-inch ; about three-sixteenths from Q R. Now commence to leave on at the top edge O P, about a quarter-of-an-inch ; P Q about the same ; Q R about three-sixteenths ; R S about one-third-of-an-inch. This completes the casting pattern O P Q R S.

To face Page 62.

Plate 35.



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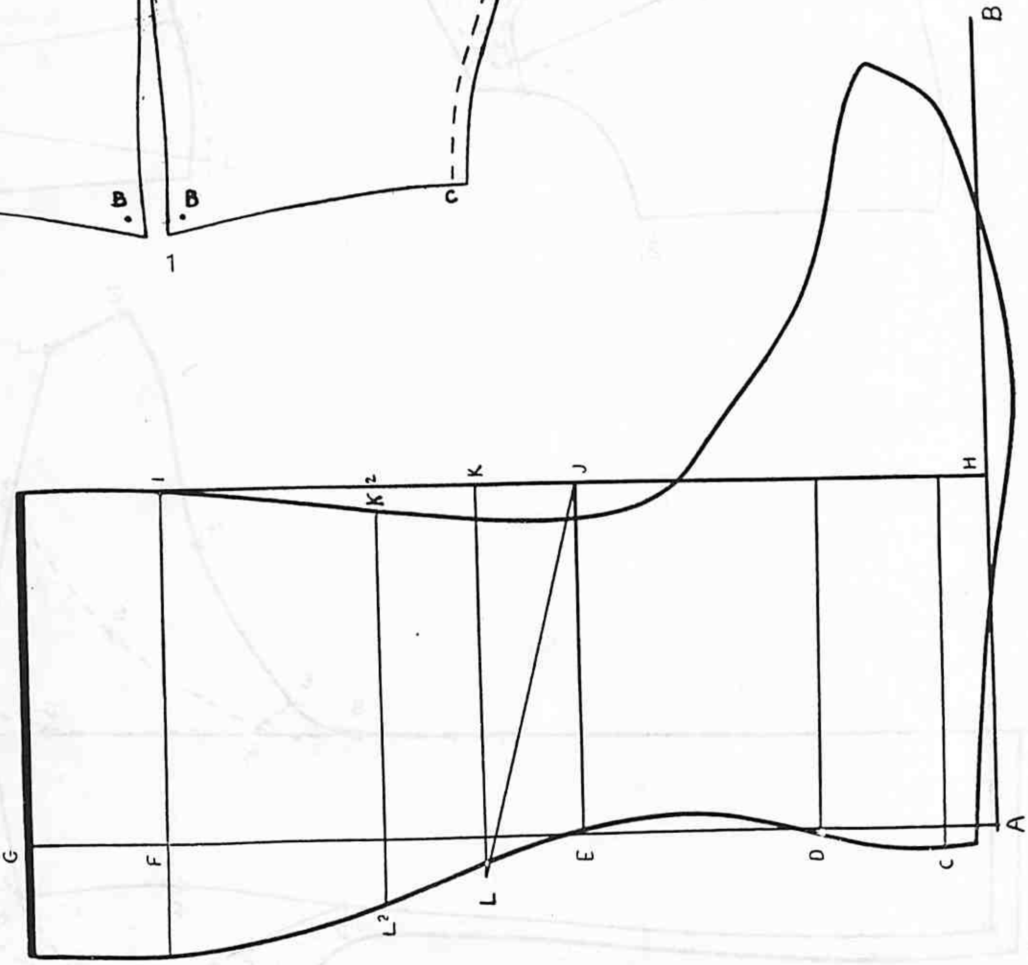

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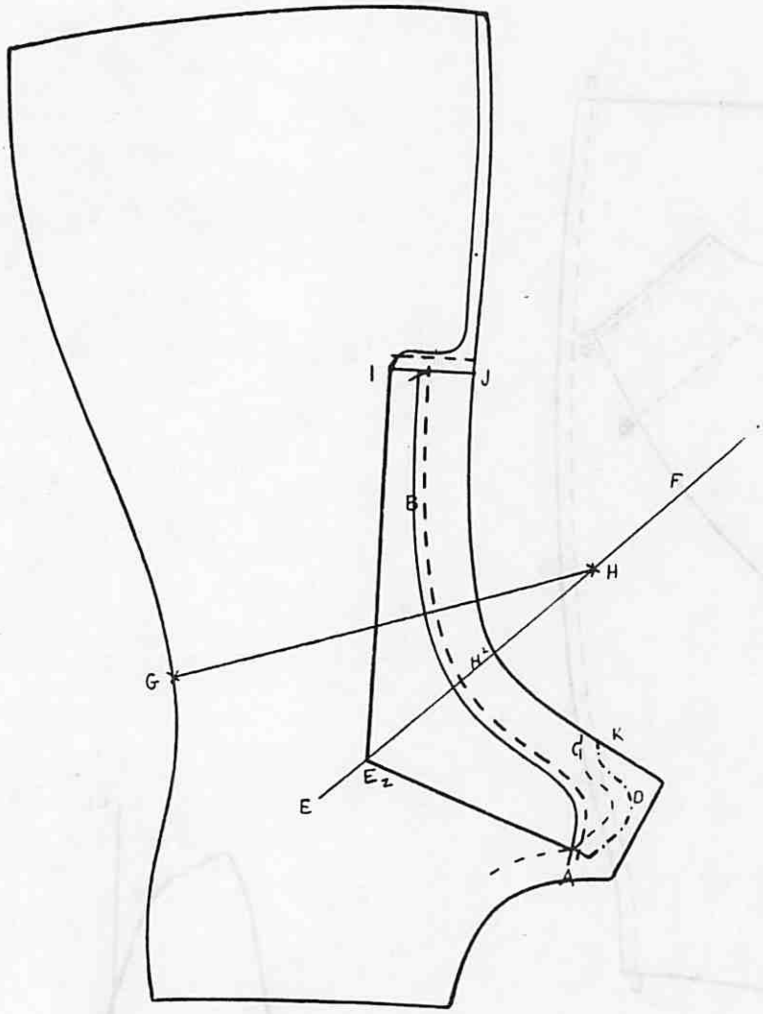
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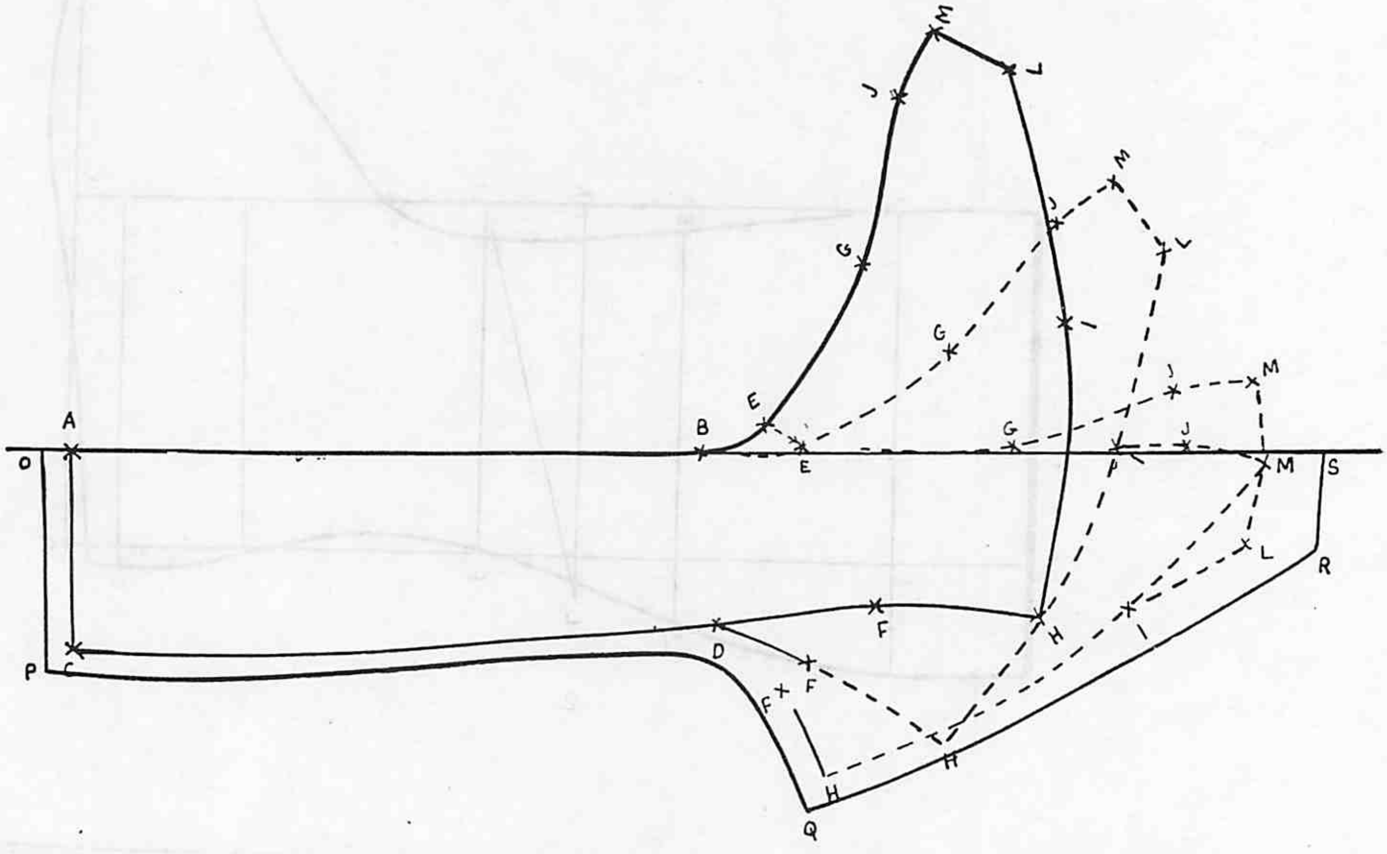
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3.

Leggings cut with blocked backs may be cut upon the principle shewn at Figure 1, Plate 38. The centre line of the leg is first drawn as A B. The calf height is represented by C; draw a line through C at right angles to A B; draw a line through A at right angles to A B representing the bottom of the legging. Measure off on both sides of A one-fourth the girth of the lower part of the legging. Assuming E to be the front and E2 the back, drop the back point E2 half-an-inch, bring it down to E3, at the calf height, measure off on each of the point C along the line D one-fourth of the calf girth as C D, C D2; draw a line from the point E and E2 through the points D and D2, meeting the line across the top of the leg as 1, 2, 3, 4. 1 and 2 will represent the lower edge of the pattern; 1, 3, the front; 2, 4, the back; 3, 4, the top; round these points the curves may be designed. The line representing the calf line will remain nearly constant during the making of the legging; it will block out a little larger, as shewn at D2. Above the calf line the leg should be drafted as shewn upon the top line. F being the front; F2 the back; G the outside calf. The difference between 3 4 and the top of the leg should be divided into three parts; one part taken between 3 F; one part at G—G being half-way between F and B; and one part at the back. This drafts the legging all the round the top and over the outside calf. G G2 should be tapered down as shewn; the seam will be covered by the strap on the outside calf. The small part of the ankle of the legging should be measured much as in a field boot. If a great deal of curvature is required, the amount required in the back after blocking must be taken out at the front as H, H2, H3, the amount being shewn at 5 at the dotted line. The first rough cast would be represented by the lines 1, 2, 4, 3, D, 5, E; this produces the casting pattern Figure 2, in which 1 2 is the bottom with an extra quarter-of-an-inch allowed; 2, 4, the folded edge of the back; 3, 4, the top, and 1, 3, the raw edge of the front. This should be seamed over, stitched from 1 to 3, and then blocked; the seam cut out and the legging laid flat. When laid out flat it would be as Figure 3. The circle about the point K, and the half-circle at about the point E3, representing the parts that are blocked out. The rounding pattern will have the circle H cut out of it, to permit the blocked up portion to come through, and the pattern to lay flat for the purpose of rounding. G1, F3, shew the pieces cut out for the draft. The fittings are shewn from I J K upon both sides. I J is the inside facing; J J K K is the back counter; this is shewn in the centre of the casting pattern Figure 2 as J2, K2, E3 L.

This class of legging rarely fits well round the top; they are usually cut too straight along the top and up the front of the leg, and consequently, do not sit well over the calf. A similar principle to that employed in cutting long boots is used for this. The line F F2 is raised at the point G half-an-inch, so that the top edge of the legging, in addition to being drafted, is raised sufficiently to go over the swell of the calf in the front of the outer side of the leg.

Assuming the line H H2 to be solid leather, it will be evident that if the curve at H2 is blocked in, there would be a superfluity of material at the point H. Therefore, the curve that is required to be blocked from H2 to E, has to be cut away from the front. The slight swell at the bottom at E3 is naturally produced during the process of blocking.

Patterns for bespoke work are most rapidly produced by what is called the "direct method." The student will already be familiar with the usual construction lines used in producing a standard pattern. The bespoke pattern having usually some peculiar measurements, would require rather special treatment. Commence by drawing the construction lines Figure 6, Plate 22, as A B, B E, E F, F G; make E F about one-sixth-of-an-inch more than half the ankle girth; lay the last down upon its

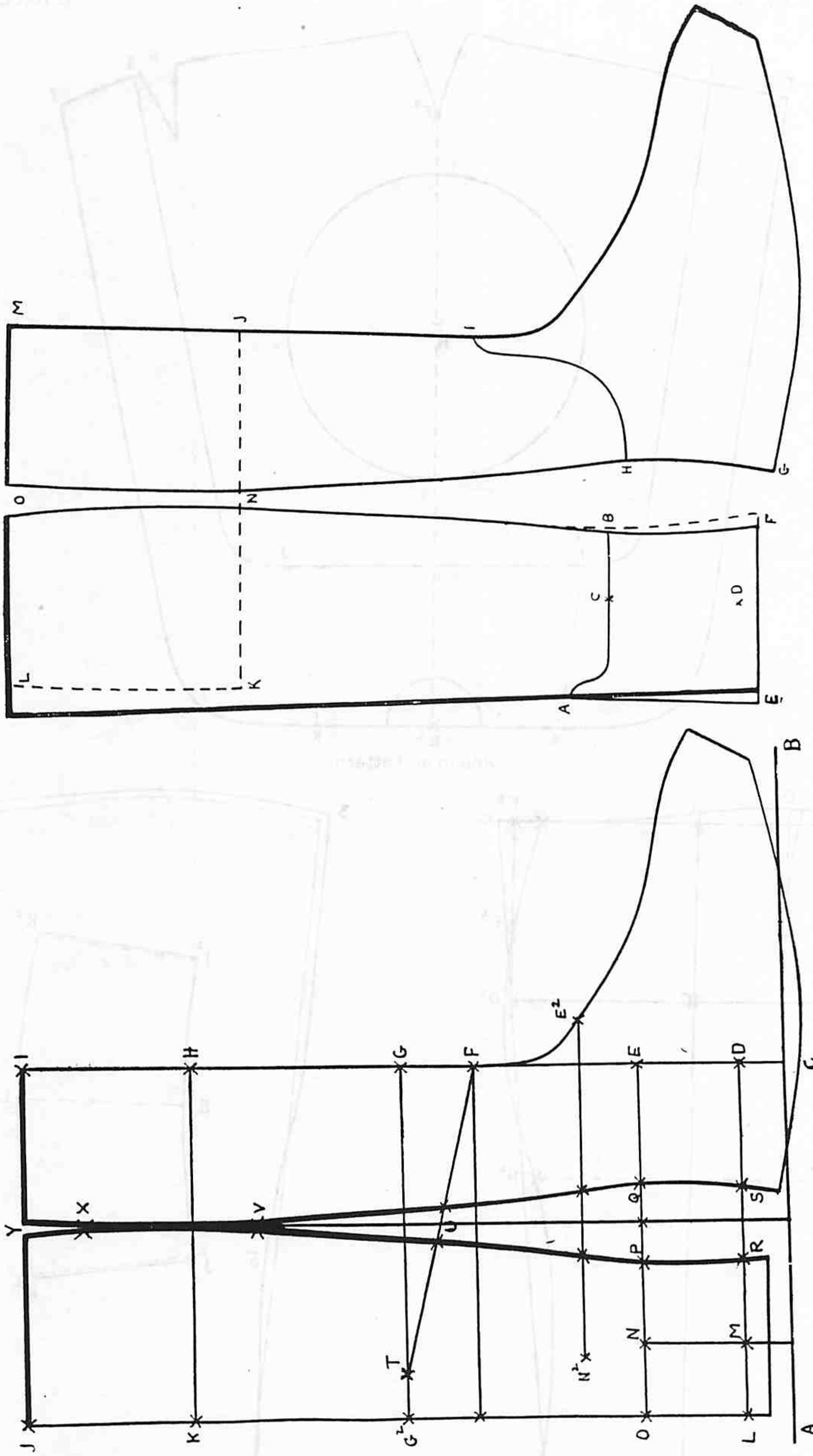
side so that while the joint and the last touches the ground line in the point H, the side of the seat is against the point C ; pull the paper round the back of the last, holding the last down with the other hand firmly upon the paper, and see whether the point D is in the centre of the back of the last; if not, move the last backwards or forwards until the point D is in the centre. Now mark the profile of the front of the last from the toe to the instep point J, and along the bottom from the toe past H to the point C, down the back through the point D towards C ; this will give a rough representation of the forme. Commence by leaving along the bottom edge a little more than the amount you want for lasting ; cut a curve down the back, past E, D, C, at about a quarter-of-an-inch from them. From the point C through the heel line, made as previously described, measure over half-an-inch more than the heel measure given. Now roughly cut the paper out at about half-an-inch from the front line and the points made at instep heel and ankle ; lay the pattern on the side of the last, holding the paper [illegible] down with the fingers of one hand, and drawing it round the last with the other ; mark upon the pattern where the paper crosses the centre of the line—this will give a fairly accurate guide to the front curve. Trim the pattern away until it is the shape of the last and the dimensions of the heel and ankle. As the curve is cut away between E and D, it naturally reduces the dimensions of E F towards 'e' ; mark 'e' about half-an-inch from E, and F to 'e' equals half the ankle measure. Generally, bespoke work being well lasted, the patterns have a backward pitch.

The heel measure of bespoke work is of great importance. It should never be cut exactly to the measure sent, or the measure of the foot, because lasts being of a different shape round the heel to the heel of the foot, naturally leave some waste space in the seat of the boot. This amount varies with the shape of the seat of the last, and although it is mentioned in special reference to bespoke work, it applies to all other classes of work. It may be taken that the point where the pitch line meets the edge of the seat of the last is approximately the true position from which to take the heel measure—this leaves a greater or less measurement behind the pitch line. Where the seat is very round the pattern comes nearly back to the pitch line ; where the seat is very square there is a great prominence standing away from the pitch line at the back of the pattern. These differences are owing to the differences in the shape of the lasts, and have no connection with the differences in the shapes of the heel of the foot. If the measurement is taken from the extreme back of the heel of the pattern, there should be an increase in the pattern over the heel of the foot as given in the bespoke scale. Of course all these measurements are to be taken not including the lasting allowance.

Heel measures for standard boots are very difficult to determine, because they are largely affected by the shape of the comb of the last. Ladies', size 4's, 3's fitting, should be well suited by a 11-5/6ths heel. The measurement upon the pattern will be of course half this. The differences in the girth of the foot will be one-third-of-an-inch. Upon the pattern this would be one-sixth-of-an-inch. Men's, size 7's, 3's fitting, would have a 13-inch heel with a difference between size and size on the pattern of one-sixth-of-an-inch.

Ankle measures between fitting and fitting would vary as instep measures. The standard ankle measure, size 4's, 3's fitting, ladies', would be seven-and-three-quarter-inches ; the difference between fittings, one-eighth-of-an-inch. Men's, size 7's, 3's fitting—ankle measure, eight-and-three-quarter-inches ; the difference on the profile pattern, one-eighth-of-an-inch. The grade between sizes will be as the grade of the joint. In children's work, the girth of the ankle will equal the girth of the joint ; therefore the pattern will equal half the girth of the joint. The difference between fittings would vary as the insteps and as the adults'.

Plate 37.

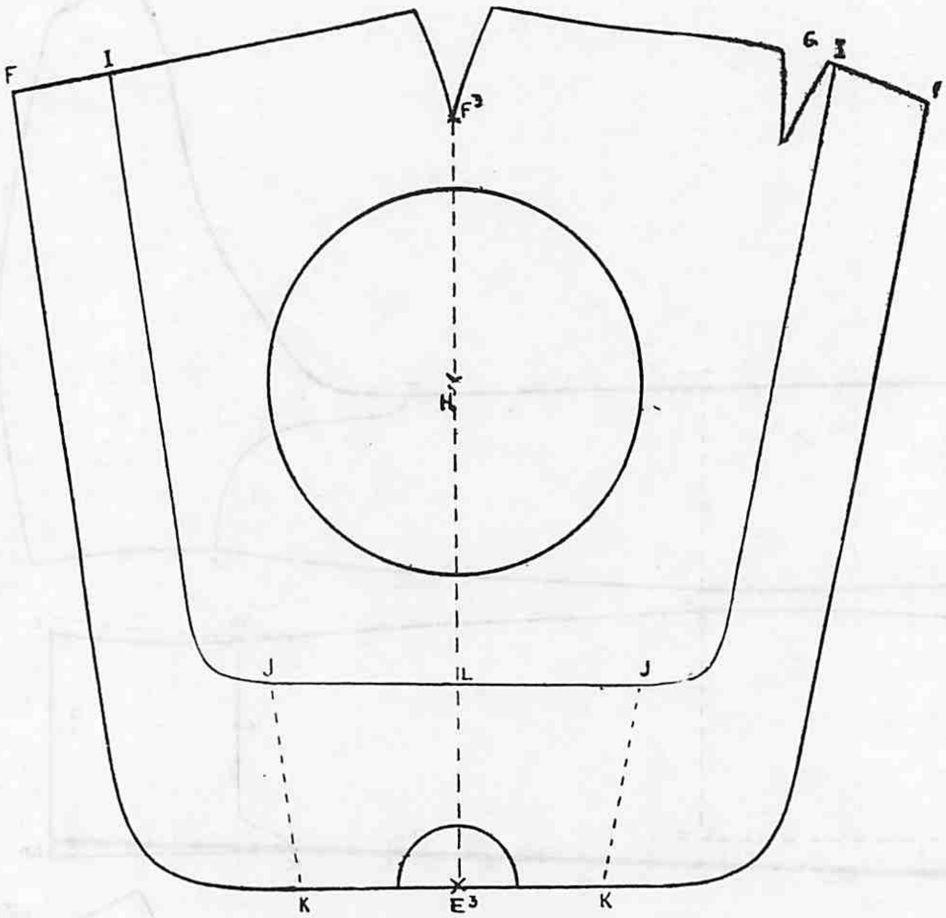


2.

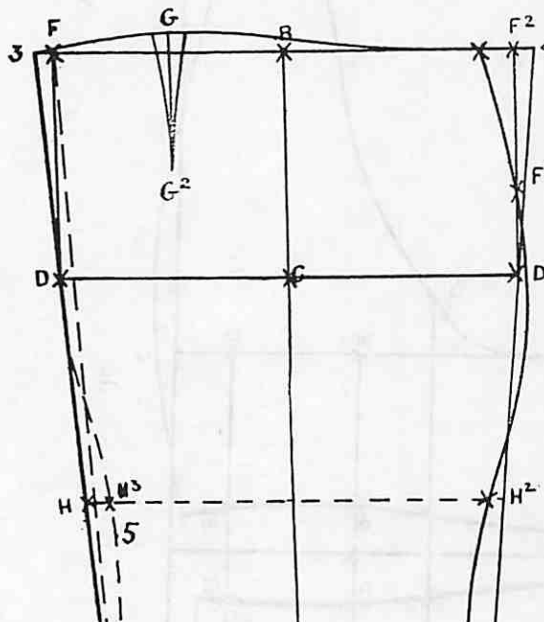
1.

Wellington Boot.

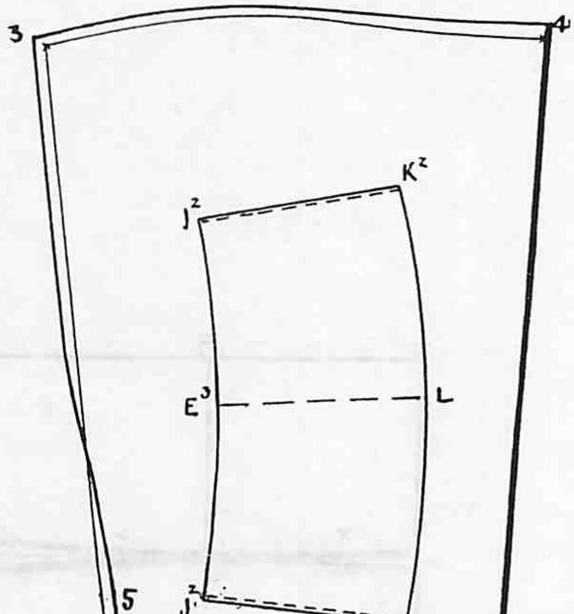
Plate 38.



Rounding Pattern.



Principle of Construction.



Casting Pattern.

The principle upon which patterns are graded into sets has already been described in its application to sole shapes on Page 42. We now have to consider the application to the grading of upper patterns. In its simplest application, the radial system produces a set of patterns of precisely the same shape and precisely the same proportionate measurement, that is to say, if you doubled the length of the pattern by the radial method, you would at the same time double the length of every line on the pattern. This proportionate increase is not the same as the increase made in lasts. Most last-makers grade to the scale given in that section or to some scale of their own, which is certainly not in geometrical proportion, the consequence is, that we have to provide in the upper pattern for certain differences in the lengths of lasts, and for proportional differences in the different parts in connection with the lengths, and at the same time provide for a difference in girths that has no geometrical connection with the length grade.

Another matter very often disregarded is, that the difference in the profile length of the last is not exactly the same as the difference required in the long length of the pattern, because the pattern, in addition to going the length of the last, and therefore the difference in lengths between size and size has also to reach round the last, and as the lasts vary in widths and therefore take up different amounts in going round, there should be a grade to provide for the difference in widths as well as the difference in profile lengths. Figure 1, Plate 39, will help to explain this.

The profile of the last is connected by the line AB. The corresponding length of the pattern going between each point is 'a' to 'b.' Seeing that the line AB is graded a size between size and size, and that 'ab' has to go over the width as well as this additional length there should be a greater difference between the length of the pattern than there is between the profile lengths of the lasts. If the sole shapes be graded proportionally, the actual amount would be in the ratios of the line lengths; but as lasts are not graded proportionally, there is a very slight deviation from that amount. However, the line 'ab' is for all practical purposes the correct line length, and if we grade its length proportionally to the profile length of the last, or we make an equivalent difference between the length of the pattern and the length of the tool, we shall provide for the difference in the grade, between the last and the pattern. The girth grade of the last, and therefore the width grade of the pattern, is decided by some fixed standard measurement. Most lasts are graded in a difference of girth of a quarter-of-an-inch, and a difference in width of 1/12th-of-an-inch; if we deduct the 1/12th-of-an-inch grade from the quarter-of-an-inch girth grade at the joint, we have a top grade of the last of 1/6th-of-an-inch. Seeing that the pattern represents half of the top grade, we should therefore require a difference across the part representing the joints of 1/12th-of-an-inch, *i.e.*, half the 1/6th. Let us assume that the line CD represents the line of the joints, and that the line EF represents the line of the instep, the difference in instep girths is a quarter-of-an-inch. The average difference in the grade of the waist of a sole shape is 3/64ths; if we deduct 3/64ths from a quarter-of-an-inch, we have 13/64ths; providing for one half of this we require a difference of 13/128ths in the grade between size and size for the instep. By the same method of reasoning we arrive at the differences in the heel measurements or other measurements. Returning to the joint measure and assuming that the grade of the forepart of the last is in proportion to the joint, we should therefore require grades in the forepart which would be proportionate in its differences to the grade at the joint.

Differences are also often required between the grade produced in the height of the leg by this system, and some arbitrary fraction, which it is the custom of the trade to use; generally, one-

eighth-of-an-inch difference is required in the height of the leg for men's and boys', and one-sixth for ladies' and girls'. If we assume a man's pattern to be five-and-a-half-inches high for size 8, we should naturally produce a grade of one-sixth-of-an-inch between size and size in the heights of legs. In a lady's boot, size 5, seven inches high, the natural difference in height would be seven-thirtieths-of-an-inch, or nearly a quarter-of-an-inch.

It is therefore evident that we must devise some means of arranging line lengths similar to those arranged in sole shapes, that will give the grades required across the different parts, and still preserve the shape of the outlines.

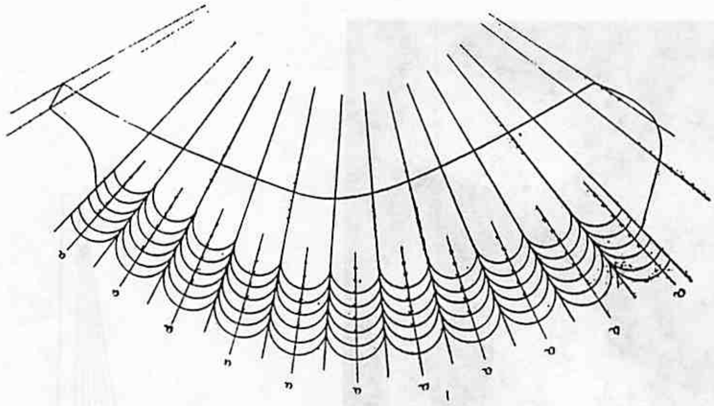
A consideration of the tool may assist us in determining how that can be done. Figure 2, Plate 39, represents the radial grading tool, in which the line B b represents the length of the last; A b the length of the pattern passing over the last; the vertical line C represents the grade in the length of the last; therefore, 'b c' represents the grade in the patterns. If we divide A B in four parts, we shall find that the division passing across the part nearest A has differences of twelfths-of-an-inch; this must be so because a twelfth is quarter of the size. Therefore, a twelfth being the correct grade for the joints of the pattern, we mark C d a quarter of the length of A B. We mark E f three-tenths the length of the tool, that being approximately the correct grade there; if we require one-sixth of a difference in the height of the leg, we mark from G towards H at 'h' half the length of the tool. To determine the grade of the forepart we make a tool as C D, which is similar to the tool made for grading the width of sole shapes and is used in the same manner. Where such mathematical accuracy is not desired, the student may focus the pattern at A2, lift it up until the outline goes through 'd,' and mark the bottom along there. If a line is drawn from the centre of the top curve to the centre of the ankle, as shewn, and the top of the leg drawn down until the back touches H, as dotted line, this lower line will form the grade line for the top of the leg; any points made on this grade line would have corresponding points made at the top of the leg, and the grade transferred to it.

Theoretically, it is assumed that when we artificially lower the top of the leg, we should at the same time lower all the points at the back curve proportionately; this may be done by drawing short lines vertical to the ground, as 1, 2, 3, 4, making a supplementary tool, as shewn at the back of the leg, and pricking off the amount required at each point; each of these lower points will represent the grade points for the outline immediately above it.

The method of working this is generally called the "Transferred grade." I believe that I am responsible for the original idea. Figure 3 will help to explain the principle. We will assume that A B represents the line length of the pattern, and that B1, B2, B3, differences in the grade of lengths. If we were grading a pattern of the width of B I, the difference in the grade between size and size in width would be as that shewn by the line A J at i1, i2, i3. If the width of the pattern was as B C, then the difference between size and size would be that made by AG, as c1, c2, c3. If the width of the shape was BE, then the difference made would be that by the line AH, as e1, e2, e3. Now each one of these differences in width between size and size are also differences in the amounts of the grade made by the different lines, although the line length of the pattern is the same. Therefore, it is quite evident that where lasts have the same grade, patterns of different widths cannot all grade up correctly.

This difficulty may be overcome by assuming a width that represents the correct grade, and transferring the amount made by it to the true outline of the pattern. Let us assume that the line

Plate 39.



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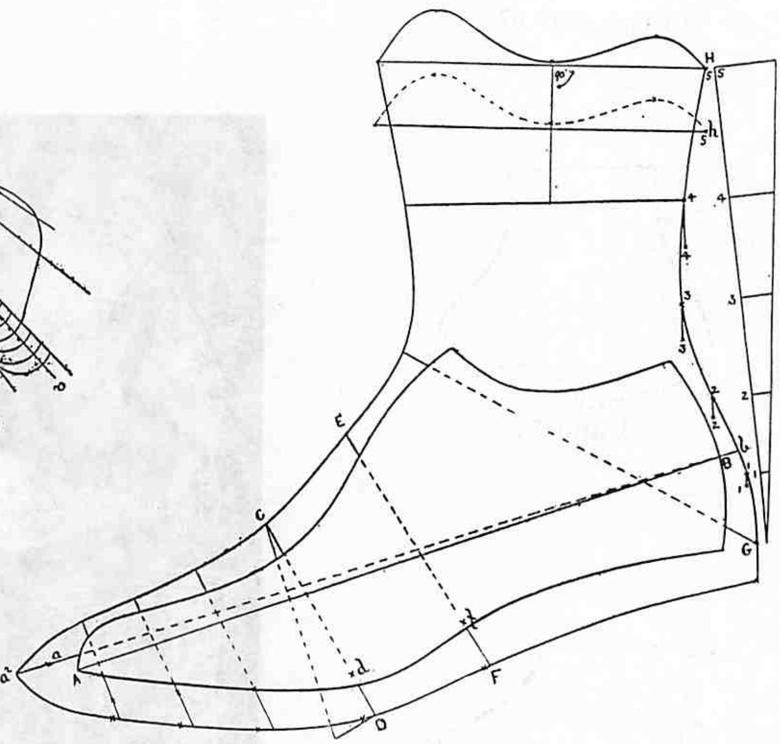
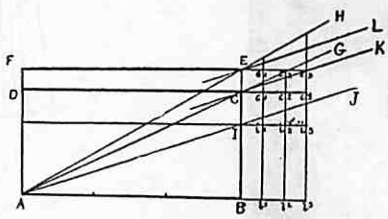
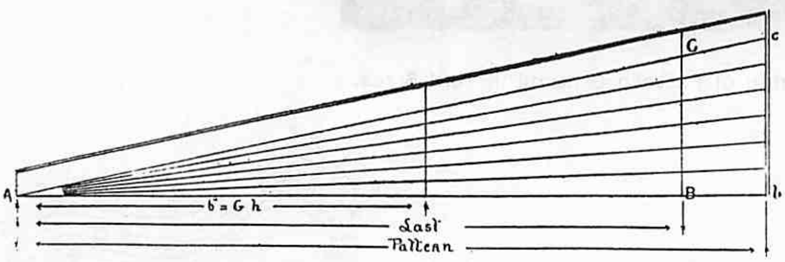


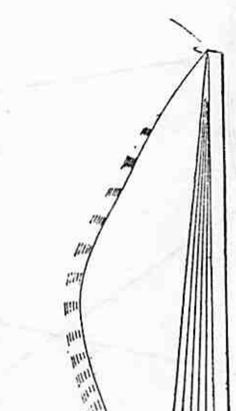
Determination of Grading Lines.—1.



Principle of transferred Grade.—3.



"Raeial" Grading Tool.—2.



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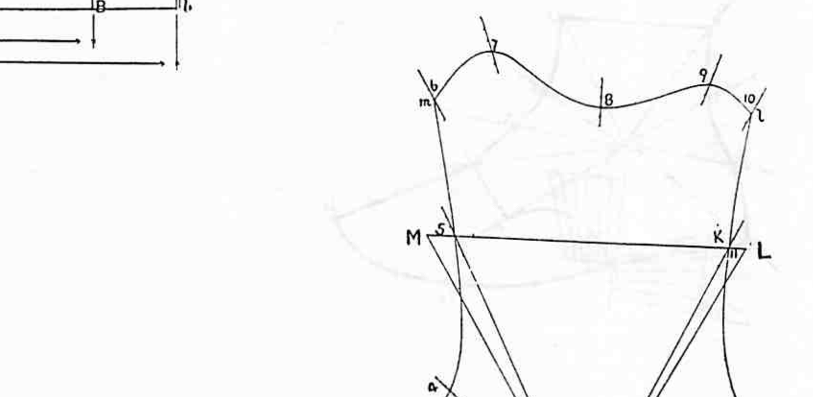
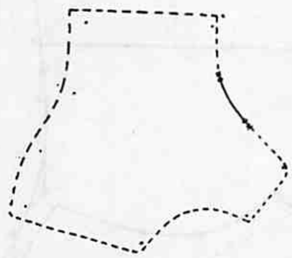


Determination of Grading Lines.—4.

Plate 40.



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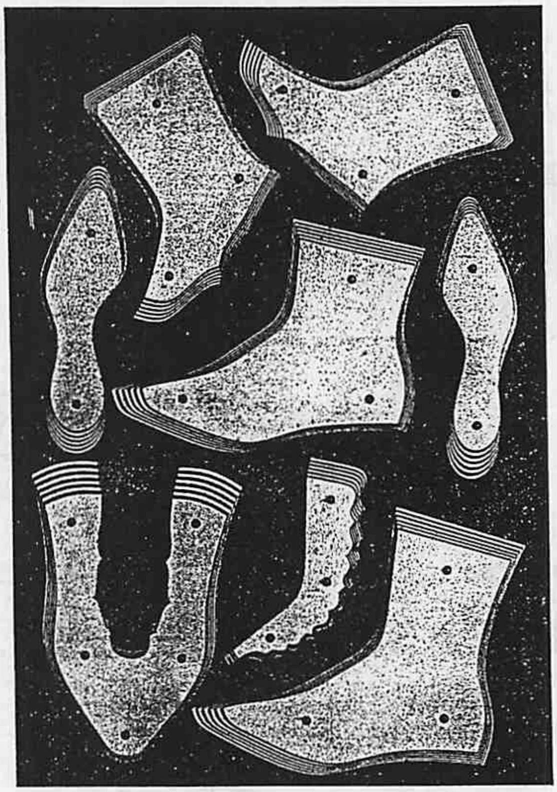
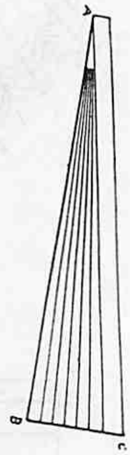


Specimen of Pattern Grading in Half Sizes.



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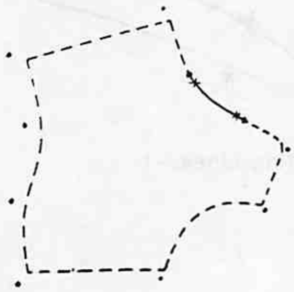

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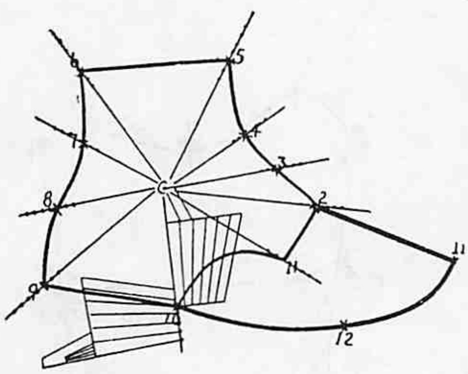

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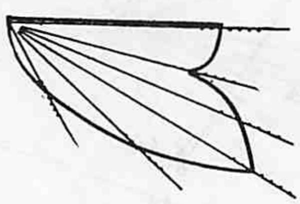

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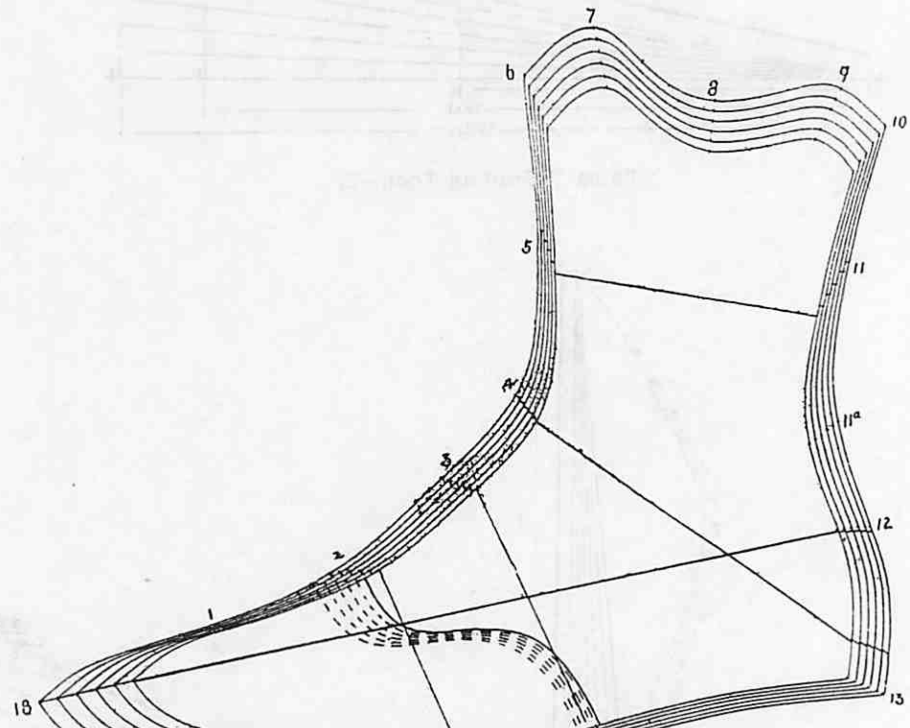


Set of Standards.

A J represents the grade that we require. If we draw through C and D lines parallel to A J, as C K E L, we shall have precisely the same grade as at A J, because the slope of the line towards the base line A B is the same in each case ; and as the differences between B 1, B 2, B 3, are the same, the difference in the width grade of each of these will be the same, no matter how wide the different parts of the oblong is. This is really an explanation of the principle of the "Transfer grade."

The practical method of working this system is as follows (See Figure 4) :—Draw the outline of the standard pattern ; mark off the joint line and instep line ; make a radial centre in any convenient place ; draw a line from the toe through the counter point, as A B ; from B, in the direction of A, mark off the length of the pattern, minus lasting allowance ; mark points round the outline of the pattern as 1 to 18 ; from the joint point D draw the joint line D E, make it a quarter of the length of the tool coming to the point D E. From F towards G draw the instep line, making it three-tenths the length of the tool. The amount cut off at the joints may also be cut off at the seat, as H. Focus the toe of the pattern on the point A 18 ; lift up the bottom until the outline touches the point E, mark I J ; lower the top of the pattern to the line K, drawing dotted lines as previously explained, and make points 6, 7, 8, 9, 10. Now from the radial centre C, draw lines 1, 2, 3, 4, 5, and to 11, 12, H, G, E, I, J. On the outline of the pattern representing J, draw a line parallel with J, as 17 j, passing across the outline of the pattern ; at 16 i do the same thing in reference to I ; at 15 e do the same thing in reference to E ; at 14 g do the same thing in reference to G, repeat this at 13 H. The lines passing through L M represent the top corners of the leg. The points representing 7, 8, 9, are not shewn, they would be produced in exactly the same way as the others. To mark off the exact amount required at each point, proceed in as sole shape grading. Lay the point of the tool A on the radial centre C with the edge A B on the line you wish to grade ; where the tool meets the radial point on the outline of the pattern, or on the mark representing it, is the position of the right-angled line or fold that gives the correct grade across the tool for that part. If the tool is laid to the outline of the pattern, as 1, 2, 3, 4, the grade is pricked off along the line as in sole shapes ; where it reaches the nominal point as E G H I J, the grade is transferred to the outer edge or, in the case of L M, to the top of the leg. These points are pricked through as previously described from a stencil. The complete set of standard patterns produced by this method is shewn on Plate 40.

Where an alteration is required in the grade of the height of the leg, the same alteration is required in the parts connected with the leg as in a button piece. The method of producing a set of scolloped button pieces is shewn at Figures 5, 6. The quarters being graded out (Figure 5), and placed level at the point A, are knocked up on the level surface, when the top corners shew a grade as 2, 3, 4, 5, 6, 7 ; this represents the grade of the line length of the front seam. A tool should be made as A B C, in which the length A B is the distance between the two corners, and B C as differences equal to the grades 1, 2, 3, 4, 5, 6, 7 ; this forms a Supplementary tool.

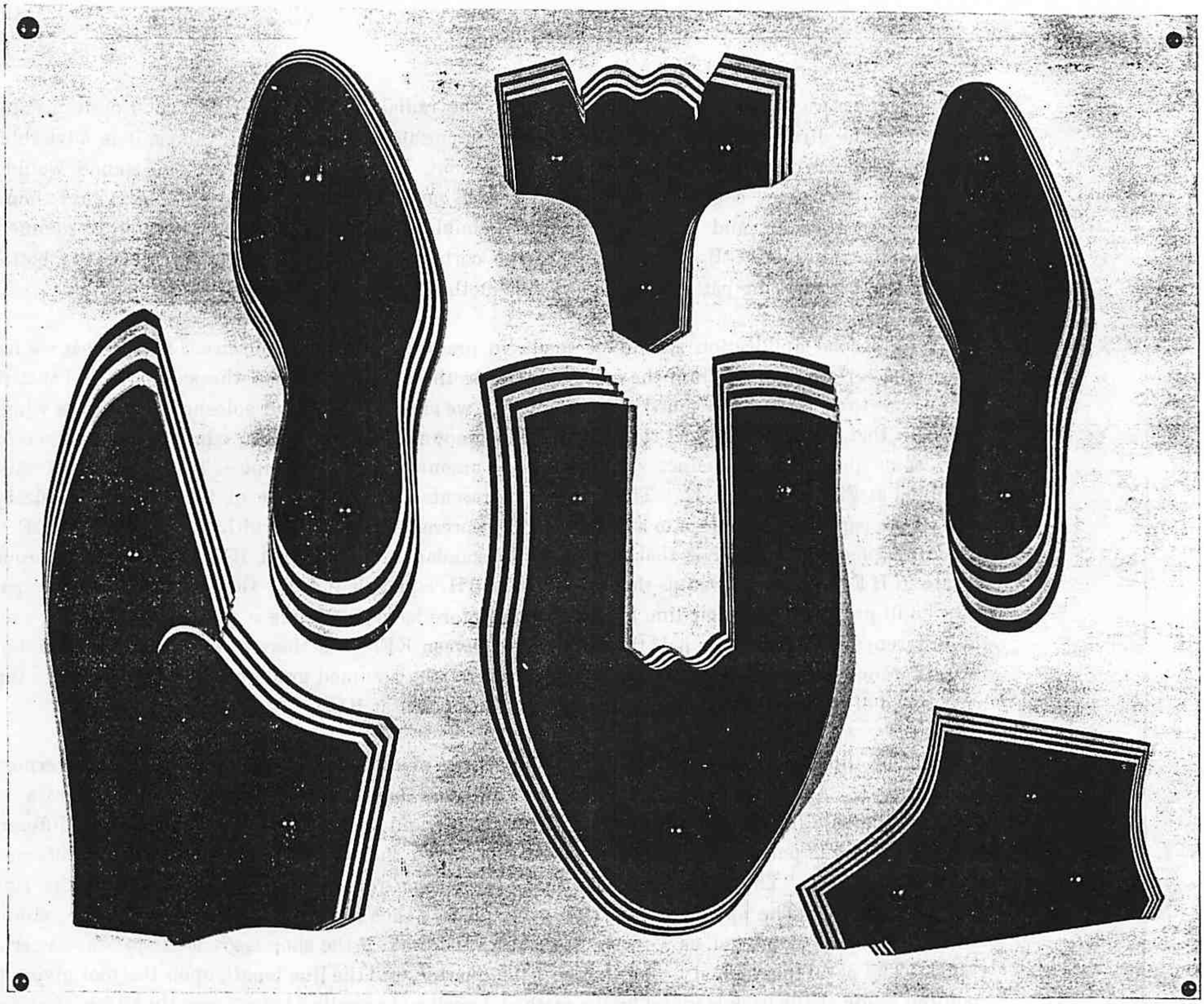
The centre size is then marked out. A point in the position shewn in Figure 6 is made, representing the radial centre and lines through the points of the button piece as 'a a a a a.' The tool is then applied to the points of the button piece precisely as in grading other parts, and the points connected precisely the same as in other grades, producing the set of scollops, as shewn.

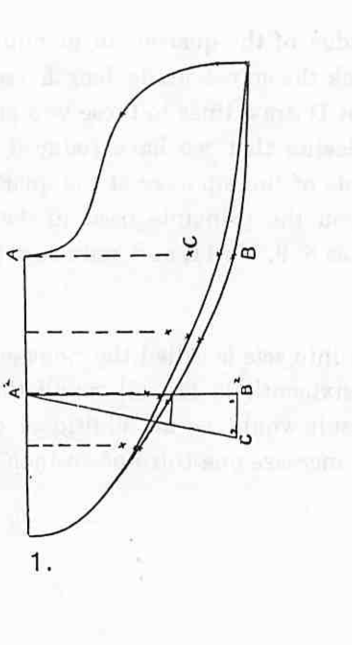
The principle of the grade is not in any affected by the unit used. Where Continental points are used as Paris points or centimetres, the amounts are marked on the line B C on the tool, and the

tool finished in precisely the same way as for other sizes. If a difference is required in the girth grades that contains a very minute fraction, the amount can be determined by measurement, and the corresponding division found on the tool. The length from the point of the tool to where the division is, represents the line length of the pattern over that part. We will assume that a set of patterns is required to be graded in Paris points in length and in half-centimetres for girths, and 1 6th of a centimetre for widths. First mark out three centimetres in half-centimetres; from the line length found, deduct one centimetre; the amount left, divided by six, will represent the total grade of the girth, minus the grade across the tread, half that amount is the required grade across the joint. Find the position on the tool where the divisions equal this amount; the line length from the point A on the tool, to where these divisions commence across the tool, is the correct line length for the patterns across that part. A specimen of this grade is illustrated on Plate 41.

The simplest application of the radial system is illustrated on Plates 40, 41. A tool is made of the length of the standard pattern, as A B; a line is drawn from B at right angles to A B, as B C; from B towards C mark sizes taken from a size-stick or steel rule, connect each one of these points to A; now cut out, leaving a margin from C to A, as shewn, to distinguish the top edge from the base line A B. It must be remembered that in folding the tool, the edge A B must always come together so that any folds across the tool are at right angles to A B. Having made the tool, now make points on the pattern as 1, 2, 3, 4, Figure 2. Place the pattern down on a piece of clean paper and mark it carefully round the edge, producing the outline; prick holes in the outline at each of the places that you have marked on the pattern; remove the pattern and make a radial centre as shewn; from the radial centre draw lines through each one of the holes made on the paper. Now place the tool with the base line A B on one of the radial lines, with the point A on the radial centre C; where the edge of the tool comes over the outline of the pattern, fold the tool back; the differences in the lines across the edge of the fold will be the amounts to be left on at that point. Turn the tool round so that the folded edge is on the radial line, with one of the points on the tool level with the hole on the outline; prick off along the radial line the distances between the lines on the tool—this will give you the grade between size and size at that point. By arranging them on both sides of the outline in the number of sizes you require larger and smaller, you secure the grade of sizes. Repeat this at each one of the lines from the radial centre. When all the holes are pricked, cut out the paper about one inch outside the holes furthest from the centre—this will form a stencil. To get the sizes from it, place it down on a piece of paper and prick through the holes representing the size nearest to the outline marked, move the paper and proceed to grade out the fresh pattern To do this, place the toe of the standard pattern on the hole representing the toe of the pattern to be graded with the front line of the standard, against the hole representing the first line of the pattern; mark or cut from the toe to the first hole, now shift the standard back until the second mark on the standard is the same distance from the second hole of the new pattern, as the first mark on the standard is from the first hole, keeping the edge of the standard exactly across the centre of the two holes (see Figure 3). Repeat this all round the pattern. If you grade to the larger size, the marks on the pattern will be on the inner side of the holes at each move, as Figure 4. If you grade to the smaller size, the marks on the pattern will be on the outer side of the holes, as Figure 5.

After producing the first two patterns, one larger and one smaller than the standard size, you must use the patterns cut to grade the next size—larger or smaller. For instance, if you commence by cutting a boy's 3's, you would cut a 2's and 5's by the standard; but you would use the 5's cut to grade the 6's, and the 6's to grade the 7's; you would use the size 3's cut from the standard to grade the size 2's, and the size 2's to grade the next smaller size, and so on.





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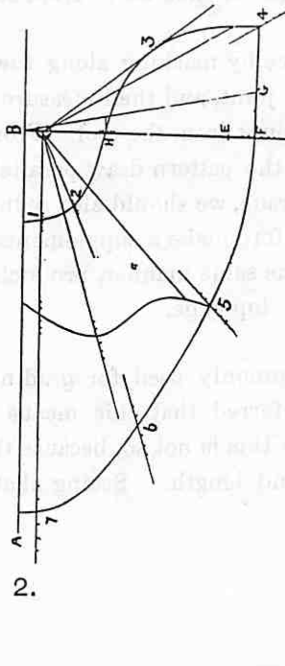

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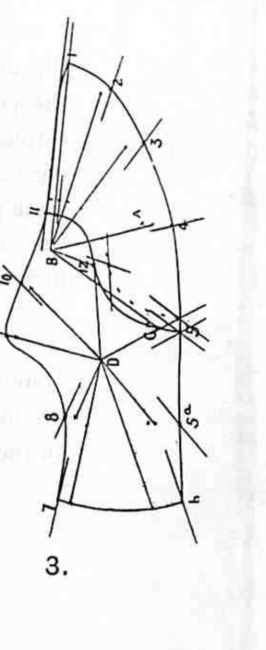


3.

Some care should be taken as to where the radial centres are placed, good positions are as Figure 2. The direction of the radial lines is also important; when cutting vamps, it is advisable to start the radial centre from the toe end, as Figure 6. The top edge AB of the stencil would be laid against the folded edge of a piece of paper large enough to cut a vamp, the holes would then be pricked right through, and the vamp cut on the double. In this case it is advisable to commence grading from the point B, grade round to the corner of the vamp and then along the bottom. Sets of practical working patterns graded by this method are shewn on Plates 40 and 41.

A special application should be made in grading vamps or goloshes. Seeing that we have deducted a certain amount from the grade line across the tread portion of the standard, and that this amount has to be deducted from the vamp, and that we expect vamps and goloshes to fit in the wing, it is evidént that we cannot deduct the whole of this amount from the lower edge; we must therefore make some provision to deduct a proportionate amount from the wing. The principle of this is explained at Figure 2, Plate 41. The line AB represents the folded edge of the vamp or the straight edge of the paper to be made into a stencil. BF represents the total width of the vamp; EF the total difference required across that portion of the standard. Seeing that BH has to be kept proportionate to HF, and that in vamps that will lock in BH, equals half HF; the grade across these parts must be in proportion to their line lengths, we therefore have to assume a point as point C, in which the difference between BC is half the difference between EF. We therefore commence by dividing the difference between the edge of the pattern and the assumed grade point at the joint into three parts; two of these parts we mark off at EF, the other part at BC.

The differences required across other portions of the front of the vamp could be determined as Figure 1. AC, CB, being the joint line, and BC being the difference, we construct a tool in which the base line AB is the width of the pattern, and the vertical lines BC is the difference made in the grade point. By placing the base line across the pattern as shewn, the other differences can be pricked off. The second line against the lower edge represents the inside line of the rights and lefts pattern. The application of this principle to a shoe is shewn upon Figure 3; the vamp of the shoe is shewn as graded, as we have described; the back of the shoe is graded to produce a certain result. The point is assumed in the centre of the quarter, and the line length upon the tool giving the required grade at the back is found by the method described in grading boots; usually 1/16th-of-an-inch is required between the height of shoe backs from size to size.

We should commence by marking along the bottom edge of the quarter an amount equal to the deduction made at the joint, and then measure up the back the actual grade length required in the pattern, taking this amount from the tool. From the point D draw lines to these two points, and through the outer edge of the pattern draw parallel lines. Seeing that we have reduced the back edge of the quarter in the grade, we should also reduce the whole of the top edge of the quarter in the same proportion. We therefore make a supplementary tool upon the principle used in determining the vamps and apply it in the same manner, producing points as 8, 9, 10, 11, and reducing the grade proportionately all along the top edge.

A method very commonly used for grading patterns into sets is called the "one-sixteenth" system. It is generally inferred that this means that one-sixteenth is left all round the pattern, producing another size; but this is not so, because the total result would be an additional eighth-of-an-inch in width, height and length. Seeing that the lasts increase one-third-of-an-inch in length

between size and size, this system strictly adhered to would not make the required difference ; it is therefore usual to leave on an additional three-sixteenths at the toe, making a total difference between the lengths of five-sixteenths, which is still far from being correct. In addition to this defect, the curves of the patterns do not come out similar throughout the set. The lines that curve outward in the pattern are graded with a fair amount of correctness ; but the lines that curve inward become bolder in the small sizes and sharper in the large, which is the reverse to what is actually required. It is the usual custom to remedy this defect by leaving on small amounts in addition to the one-sixteenth at various points ; the most common place in which this difference is made being in the throat, in the curve of the pattern above the instep.

The method is as follows :—The standard pattern is placed upon a sheet of paper and traced round with a pair of compasses, which mark off one-sixteenth-of-an-inch ; this amount is carried up the front and right round the pattern to the joint. At the toe end a quarter-of-an-inch is marked off, the toe of the pattern is then moved forward to the fresh mark made, the top edge being kept with its allowance of one-sixteenth, and the toe is connected with the joint. It would be more correct if one-third-of-an-inch was marked off on a piece of paper, the one-sixteenth-of-an-inch made on the back deducted from it, and the remainder left on at the toe.

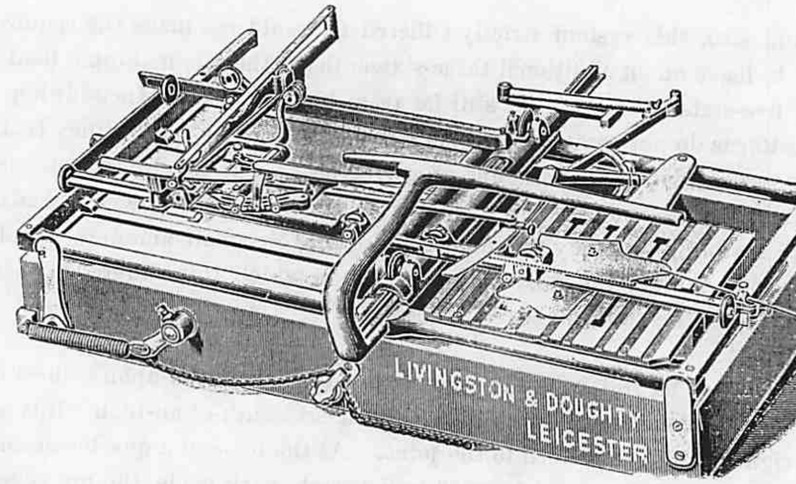
With this system, a method of grading the vamps is commonly used, which being very simple, can be applied where a single vamp or two is wanted in the workshop. The folded edge of the vamp being used as the pattern, has two lines drawn below the top edge, each 1/24th-of-an-inch apart, and the first one 1/24th-of-an-inch from the top edge ; along the lower line two awl marks are made, one 1/8th-of-an-inch from the toe edge ; the other, 3/16ths ; the pattern is then marked at the joint, half way along the wing curve and half way between the joint and the toe end. The next size is produced as follows :—Fold a piece of paper of sufficient size for a vamp and lay the pattern down upon it, so that the two folded edges are exactly level ; mark the toe end of the fresh vamp a quarter-of-an-inch down ; prick through the two holes made ; draw the vamp back until level with the first hole, lower it, keeping it level with the top edge of the folded paper until there is a difference between the two edges of 1/24th-of-an-inch ; this can be judged by the marks made on the paper ; now cut round the curve of the vamp from the centre to the mark made, draw the vamp back until the second hole is seen, complete the wing of the vamp ; now lower the vamp, keeping it level with the top edge until there is 1/12th-of-an-inch between the top edges, cut from the corner of the wing to the joint ; draw the vamp forward until the centre of the wings are level, raise the toe until it is 1/24th-of-an-inch from the top edge, cut between the joint and the point half way to the toe ; now connect the cut just made with the toe end.

The differences made in the backs will be in proportion to the remainder of the measurements left, after deducting the grade made by the vamp. This system should not be used for more than one size larger and one size smaller than the size used to grade from.

Figures 8 and 9, Plate 42, illustrate jockey backstraps or Boston backs, from a similarity to the back counter on a long boot. In this design the golosh is seamed at the side, in a straight line, as AB, Figure 8, as a curved line, AB, Figure 9, cut without a seam on the outer side and joined on the inner side, and sometimes with the seam in the centre of the waist, this latter having the whole golosh and strap in one piece. To cut the jockey back, first cut the golosh in the ordinary manner, allowing for the stiffening at the back, then having the position of the side seam AB and the height

To face Page 71.

Plate 42.



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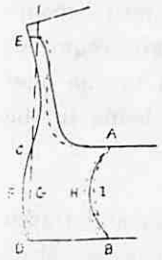

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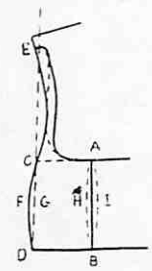

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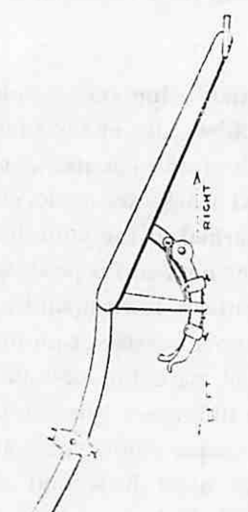

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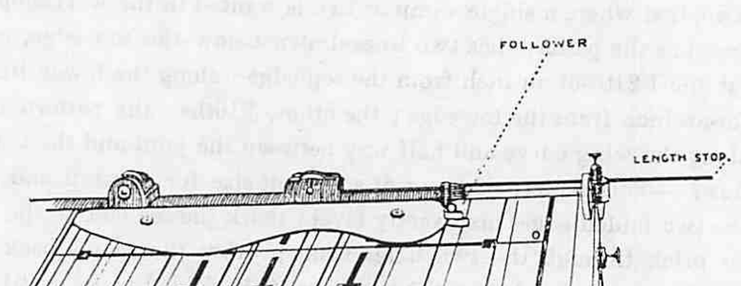

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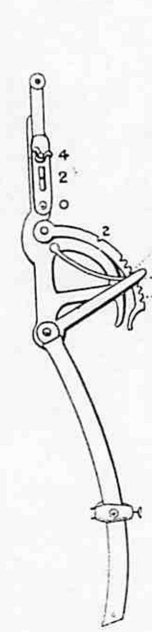
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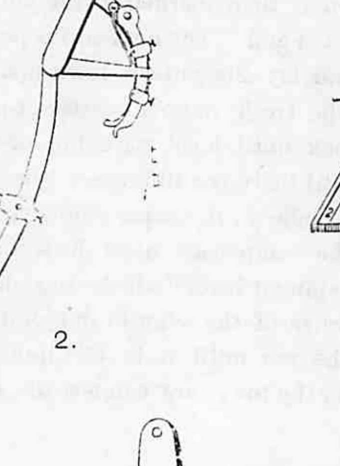
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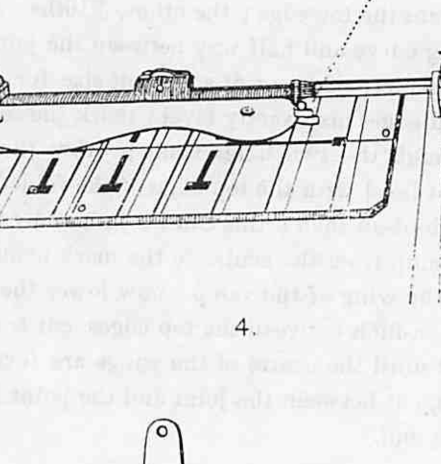

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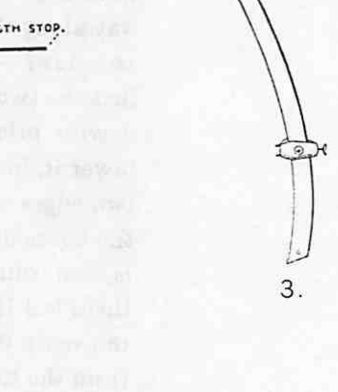
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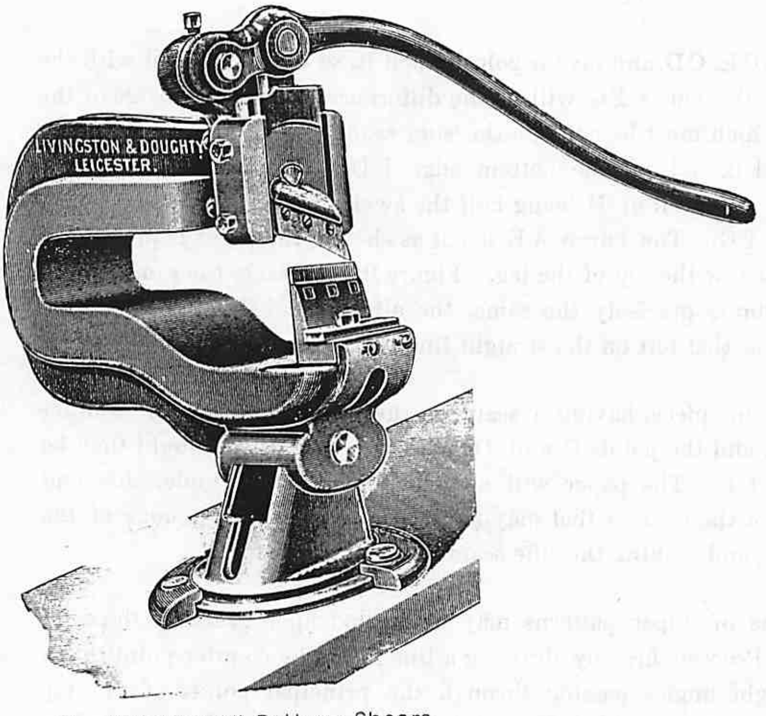
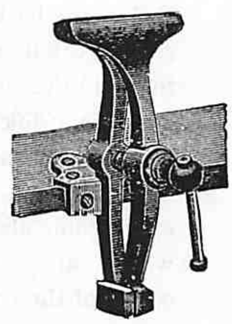
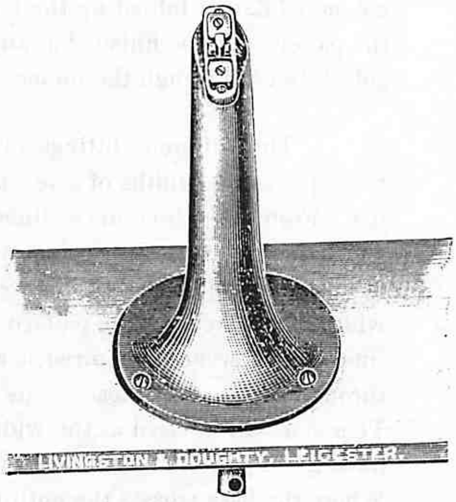


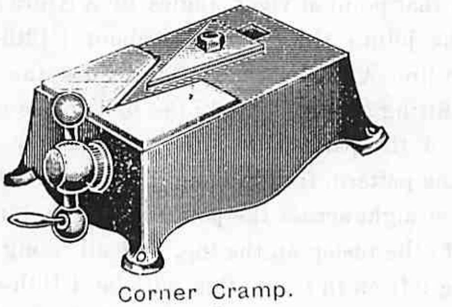
The "Hartford" Pattern Shears.



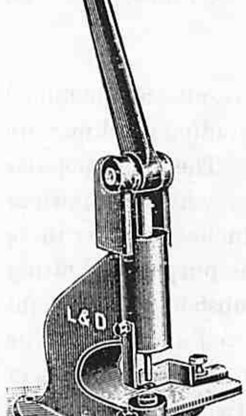
Pattern Vice.



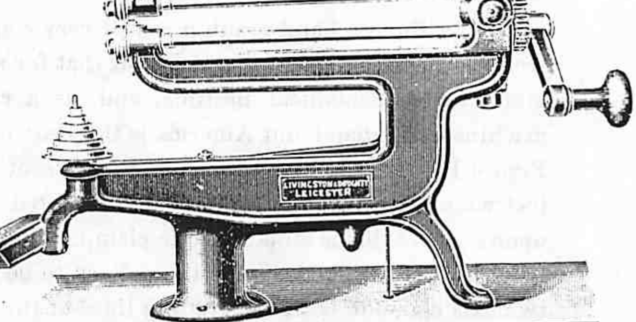
Corner Cutter.



Corner Cramp.



Pattern Punch.



Improved Pattern Binding Machine.

PATTERN MAKING MACHINERY,

By Messrs. LIVINGSTON & DOUGHTY,

Avita Works,

LEICESTER.

DE, at the back, fold a piece of paper as CE, CD, and lay the golosh upon it, so that it is level with the edge at the points C, D. The amount of the curve FG will be the difference between the edge of the fold and the curve of the pattern, and which must be cut into the side seam. Keeping the paper in its place, prick through the points A and B, and cut the bottom edge BD. Now remove the paper and cut a curve on the golosh, as AHB, the swell of H being half the swell of FG. The strap would be cut as AIB, the swell at I being half FG. The curve AE is cut as shewn, the point is preferably cut to come about a quarter-of-an-inch below the top of the leg. Figure 9 represents the same design with a curved side seam; the construction is precisely the same, the allowance IH being left in the centre of the curve in the same manner as that left on the straight line AB, Figure 8.

Where the golosh is required in one piece, having a seam on the inner side only, the counter line should be cut out to the points AD, and the points C and D marked. The paper should then be cut as AJE, and folded up the line CD, CE. The paper will now be folded on the under side, and the pattern may be finished at any part of the counter that may be wished; using the top edge of the golosh to cut through the under counter, and making the side seam as described before.

The different fittings or widths of upper patterns may be graded upon precisely the same principle as the widths of sole shapes. Proceed first by drawing a line from the counter point to the toe. From this line draw lines at right angles passing through the principal points of the top and bottom edges. The points used for grading on Plate 39 will do very well. Next construct a tool by drawing a line as AB, Figure 2, Plate 39. From the point A measure a distance equal to the width of the tread of the pattern, from that point at right angles to AB draw a line. Mark up that line the differences required across the joint; this would be about 1/12th-of-an-inch. Draw lines through each one of these points to the line A, make each of the lines the length of the tool AB. This tool will be used as the width or fitting grader. Apply the tool to the cross lines on the pattern, having the point A on the length line of the pattern, and the base AB level with the cross lines. Where the base crosses the outline of the pattern, fold the tool down. The differences across the fold will be the amount that should be left straight across the pattern at the point worked to. Repeat this at each one of the points from the toe to the instep on the top, and all along the bottom. The ankle line will require its difference in fitting left on in front, this will be 1/16th-of-an-inch. 1/32nd-part-of-an-inch should be left on at the toe end for wider fitting, and 1/32nd may be left on at the back of the heel. Connect these points precisely as in grading the sizes, and apply the same principle to each of the parts.

Although hand-grading is still very commonly used, and very beautiful results are obtained from it, there can be no question, but that for speed and practical accuracy, the grading machines are much more economical in time, and, as a rule, more reliable for exactitude. The most popular machine in England and America is the Hartford pattern grader, an illustration of which is shewn at Figure 1, Plate 42. This machine consists of a solid frame about four feet six inches long, by three feet wide. Upon the left hand side it is fitted with a sheet of plate glass, for the purpose of cutting upon; above this is an adjustable clamp, which can be used for material of any substance. The right hand base is arranged to take the pattern to be graded from; this pattern is screwed down so that its two axis coincide with the grading lines of the machine. The upper part of the machine consists of an elaborate pantograph. The frame travels on a double set of wheels, lengthwise and across the body of the machine. The working parts are connected with this travelling carriage by arms, consisting of levers, that are adjustable to produce a difference in the motion on each side, according

to scales arranged on the machine. By this means, an exact duplicate of the pattern in the machine can be obtained, or a copy, with certain differences in length or width, according to the scale fixed. The actual differences are decided by the relative position of the radius, of which there is one on each side of the machine, and of the brass bars which represent the scales. The left hand radius (Figure 2) and scale determine the width grades, which are also the height grades in high leg boots. The right hand radius and scale determine the length grade—See Figure 3.

The whole working part of the machine moves easily to the touch. Upon the right-hand side there is a small steel wheel which is pressed against the edge of the pattern to be copied ; this is called a follower (see Figure 4). Upon the left-hand side of the machine in the corresponding position there is a small round socket, into which there can be fitted either a knife for cutting, or a point for scratching, according to whether it is desired to cut out a copy, or simply to scratch cardboard or metal. The first operation in working the machine is to place the pattern over the axial line representing the length. The follower is then brought close up to the edge of the pattern and the machine set for the difference in length (see Figure 4). The sole shape is then moved until its broadest part is directly over the line O, which is at right angles with the horizontal axial line. The follower is then moved round to the side of the joint and the machine set for widths. The sole shape is then clamped as Figure 5. The paper, or cardboard, or metal is held down by the frame on the left-hand side of the machine. The operator then places the follower up against the edge of the pattern, and keeping it close to the edge, runs it quite round the pattern ; he will then have on the left-hand side, a pattern cut out or marked precisely the same shape as the one he has copied, but with the differences that he requires in width or length, and which he has set by the scales on the machine. This being repeated for each size produces the set.

The beginner must exercise some care in the actual cutting operations ; the follower must be kept close to the pattern, it must be moved steadily round. It is advisable to commence cutting in one place. Any continuous curve can be cut without any trouble, but it is somewhat difficult to cut a square corner in paper, although there is no difficulty in the matter when marking metal or cardboard.

Upper patterns are graded in precisely the same manner, but with a slight modification in the preliminary operations. The pattern is first measured in its length from toe to heel as Figure 7 ; half that amount is set off from the width or vertical line O ; and half the total difference required in the length is set off on the scale. The pattern is then measured across the instep, with an additional three-eighths ; that width is set off from the length line as shewn on Figure 6. In grading the width of an upper pattern, provision is made for the total grade of the instep ; therefore, one-eighth-of-an-inch is set off on the scale for the width grade. The grade produced will not be so much as this, as the difference made is proportionate to the width of the pattern, and the extra three-eighths left on the width of the instep of the pattern, represents the space left in the waist by the upper, and it will not be graded by the machine. The machine is set in precisely the same way as in sole shape grading, the follower is brought close up to the length grade, and the scale set at half the difference required ; it is then brought up against the width grade and set at eighth-of-an-inch. The pattern is then screwed upon the plate as Figure 7 ; the material put under the left-hand clamp, and the follower brought up to the side of the pattern, and moved round precisely as in sole shape grading. The different sections of the pattern should be clamped on the plate Figure 7, in the same relative position as the standard pattern. Where this part has a centre line as a vamp, the centre of the vamp should

be exactly on the length line O. In grading rights and lefts patterns this machine is an enormous advantage. Some care should be taken in preparing the pattern to the grading machine ; it should be remembered that the machine grades all parts of the pattern, and that if the edges are left lumpy the machine will grade those parts. Usually the first pattern is cut out of thin tinned iron. It may be cut out of zinc, or any metal that can be finely finished. If this pattern is cut out with great care, it will require very little filing before being put into the machine ; but if not cut with great truth, it must be filed up and the edges made perfectly smooth.

Usually the patterns produced on this machine are cut in mill boards, and bound with brass or steel. The apparatus on Plate 43 are those generally used for that purpose. The card is first cut out very truly with the shears ; these shears permit of very fine cutting and truth in the curves, owing to the short curved piece working against the vertical plate at the end of the blade. This curve permits of turning in very small circles. The patterns, being cut out as truly as possible by the shears, are then placed together as a set, and the whole of the edges trimmed up together. For instance, the top edges of a straight top boot would be all knocked up together, so that the corners—the front or back—are perfectly level ; while in that position the set will be put into the vice and screwed up tightly. The whole of the straight edges will then be made true by scouring with glass paper. This operation is repeated round the curves of the pattern, so that the actual trueing up and preparing the edges for the binding is done in the vice. The burr on the edge thrown up by the sandpaper is scoured off, and the pattern is ready for the binding.

The binding should commence from some one corner and, generally, carried right round the pattern to the corner started from. In some cases, however, it is necessary to cut off at several points, but as a rule, the less number of joins, the better. To get the correct length of binding required, measure the edge of the pattern with a piece of string. Starting with the one centre size, and the length of binding required, the other lengths can be determined proportionally. The actual binding should commence from near a corner ; the position of the corner having been decided by measurement, a piece is taken out by the corner cutter. The relative curve of the pattern is observed, and the binding bent to the shape by drawing it round the binding bender attached to the binding machine. By this means, the binding may be made nearly the shape of the pattern before being actually attached. Commence by turning the binding into a corner, and pushing it close against the pattern at its proper place ; press the treadle of the binding machine, which will open the two binding wheels ; put the binding in about half-an-inch from the corner ; release the treadle, which will cause the binding wheels to clamp the binding and attach the binding by turning the handle of the machine. Do not try to force the binding along the machine. Allow the machine to do its work itself. Hold the pattern at right angles to the binding wheels, and keep the curve square with the wheels when going round curves. Be careful not to run the binder over the corners. Cut the binding off close with the binding cutters, then solder the corners with hot solder ; file the corners off carefully, and the pattern is finished. All holes may be made by punching and eyeletting with small eyelets. The holes required for hanging up the patterns are punched in the pattern-punching machine.

Some difficulty is often found in bending the brass binding to very acute angles, or to form corners inside cuts, much assistance may be obtained in these matters by using the binding cramp, by which a corner of a pattern may be finished, apart from the binding machine.

Some cutters of very fine soft work prefer metal patterns, upon the ground that they lay closer to the material and permit of a cleaner cut. For light work, the most commonly used material

for patterns is sheet zinc ; this is preferred in different weights, from 9, 12, and 14. No. 12 represents a good medium substance for ordinary work, it should be cut out as true as possible with the shears. If this is done carefully, there will be very little trouble in the finishing, but if not done with care, a large amount of labour is caused in finishing zinc patterns. After cutting with the shears, the edge should not require more than smoothing round with a dull file. If there are some irregularities, they must be taken off with a smooth file, the pattern may then be run round with a burnisher or the back edge of an old knife. The burred edge cut off by a steel square edge, and the final smoothing done with emery paper.

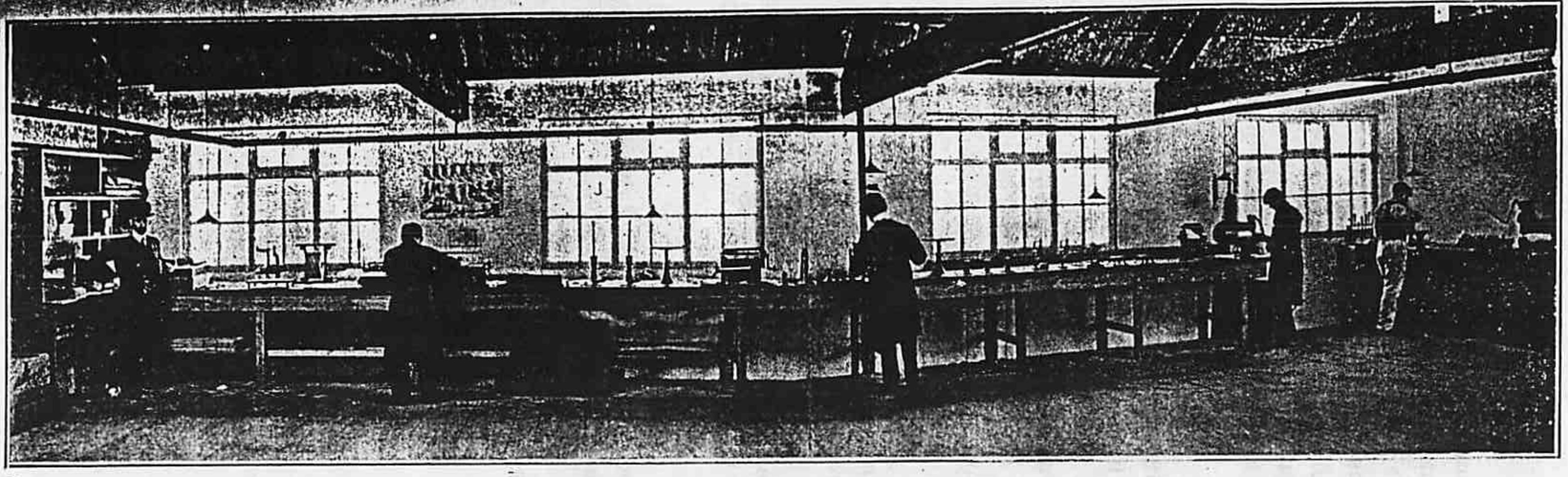
Sheet iron or sheet steel patterns are naturally the more difficult to cut. It does not appear possible to cut so truly to the edge. The shears do not leave such a fine edge as with zinc, and therefore the actual finish of the pattern has to be commenced with a file. After fine filing, the pattern has to be gone over with a dull file to produce something like a burnished edge. It is then finished with emery paper, as in the case of zinc. Sheet iron for patterns should have its surface tinned, so that it does not readily take the rust ; they are good working patterns, although rather difficult to make, and rather dangerous in the hands of careless cutters.

Working patterns should be arranged in sets, tabulated and indexed, with reference to the last which they fit ; this may be done in parallel columns. The number of the pattern being entered, it is followed by the number of the boots that it is used for ; then by the numbers of the lasts which they fit, and followed by general descriptive remarks as to their style and class of trade most suitable for. They are most conveniently kept in cases which close up, and which can be stored in regular order to some place free from the damp.

All patterns are affected by damp or undue heat, but brass-bound patterns should certainly be kept with care, otherwise any swelling of the cardboard will cause the pattern to buckle, and any undue shrinkage will cause the joints at the corners to overrun. This can only occur where great carelessness has been displayed, either in stocking the cardboard from which the pattern was originally cut, or in the keeping of the actual pattern.

To face Page 74.

Plate 43a.



The Arrangement of a Pattern Making Shop, by Messrs. LIVINGSTON & DOUGHTY, Civita Works, LEICESTER.

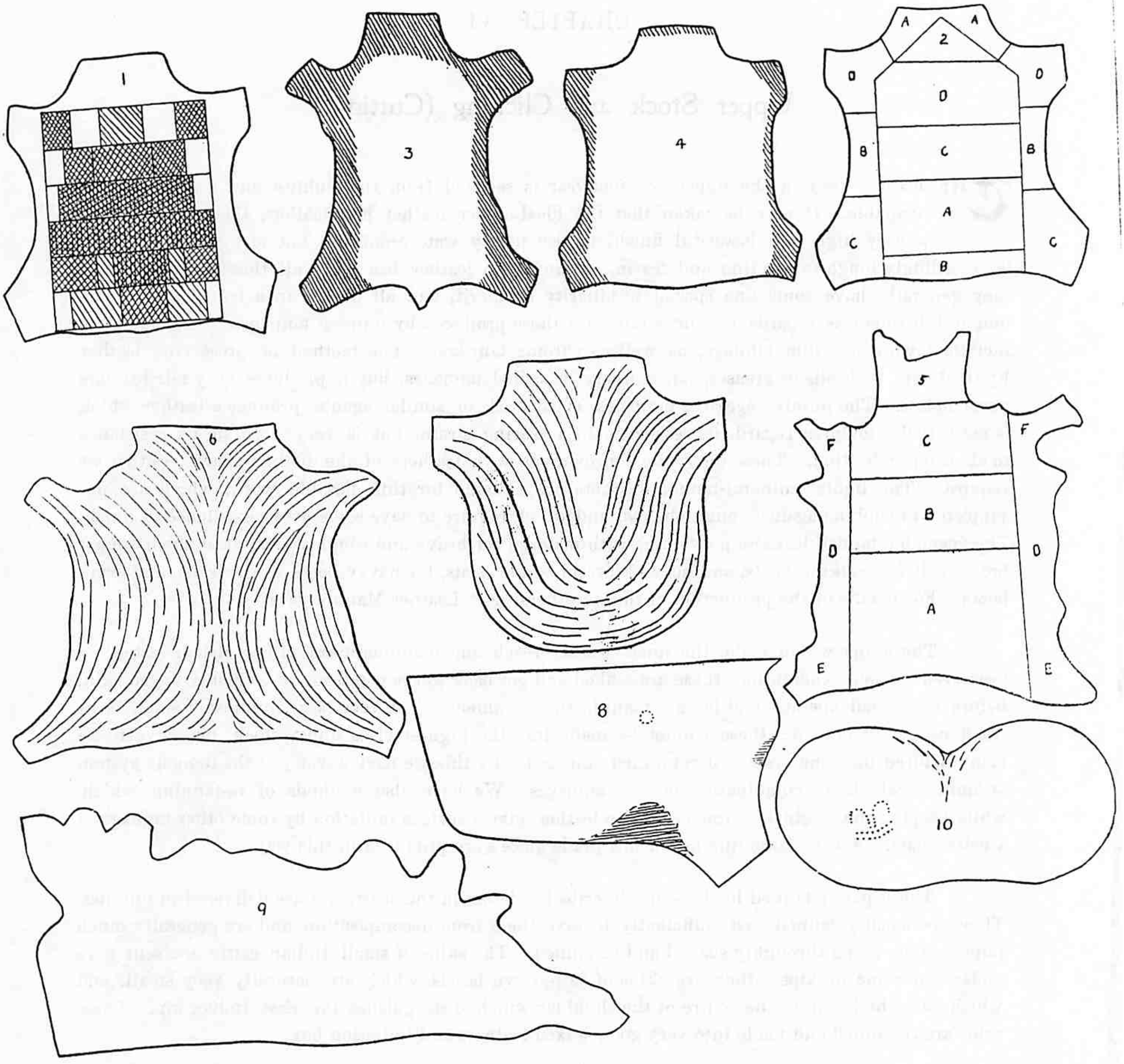
PATTERN MAKING has now become a special branch of the shoe trade, and is no longer a part of the clicking department. The arrangement of the apparatus should be in the order of the processes, or the order of most convenience. This arrangement is shown in the illustration of Messrs. Livingston and Doughty's Pattern Making Department, which represents the order in which the machines may be set out. Naturally, the storage of the material comes first, and this should be a matter of more care than is usually given it. The card must be kept in a dry, but not hot, place; the wearing quality of brass-bound patterns depends very much on the condition of the card from which they are made. If it is kept in a damp place the patterns will shrink in the working, causing the corners to overrun. This will not take place with ordinary care, but often happens owing to dampness in the cardboard used. To some extent this may be prevented by the use of specially-prepared board that is practically waterproof, and greaseproof too. Paper may be kept in rolls as shewn. The "Hartford Grader" is naturally first in the order of processes—(See Plate 42)—and then the cutters. These may be placed upon a separate extra solid bench, or on the end of the working bench. The trueing vice and scourer come immediately before the binder; and it may be advisable to emphasise the fact that defects made in the cutting and trueing up cannot be remedied on the binder; the finished pattern is just as true and level as it is presented to the binding machine. (See Plate 43.)

The preparatory machines would be arranged close to the binder. These machines, corner cutters, benders, and corner cramps, are shewn on Plate 43. The auxiliary machines and apparatus are shewn in the usual order, and incidentally it should be mentioned that in this room, as in all other departments, very much depends on system, and on the sub-division of labour; although this is a matter that must be decided by the extent of the output. The lighting of the pattern room is very important; all things considered, a front light is probably the best, indeed, is quite the best for a designer, and for a hand grader.

In the illustration, the shop is shewn extended along one front; of course, the arrangement may be quite as conveniently made round a room; in fact, in some respects, would be an advantage:—A bench in the centre could be arranged to assist in the passing of the work to the different processes. In any case, there should be a clear space between the workers for the patterns to be arranged; most confusion and mistakes in this room are caused either through want of system or want of room.

To face Page 75.

Plate 44.



1.—Relative strengths of parts of skin. 2.—Relative substance. 3.—Bad pattern skin. 4.—Good pattern skin.

5.—Division of skin. 6.—Lines of tightness in Calf and Kid skins. 7.—Lines of tightness in Seal skins.

8.—Shape of Kip Butt. 9.—Shape of Satin side. 10.—Shape of Horse Crup.

CHAPTER VI.

Upper Stock and Clicking (Cutting.)

THE leather used in the uppers of footwear is selected from the lightest and finest of skins available. It may be taken that the ideal upper leather is a leather, that while taking a very high and beautiful finish, is also nearly waterproof but not airtight, and which is exceedingly tough to bending and tearing strains. No leather has quite all these qualifications; they generally have some one special peculiarity or merit, and all others in a less degree. The toughest leathers as regards tearing strain, are those produced by mineral tannages; these tannages include tawing or alum tannage, as well as chrome tannages. The method of preserving leather by treatment with oils or greases, can scarcely be called tannages, but it produces very fair leathers nevertheless. The purely vegetable tannages, as oak bark or similar agents, produce a leather which is not actually tough as regards its resistance to a tearing strain, but is very high in its resistance to abrasion or friction. These distinctions provide us with leathers of the distinct characters that we require. The lighter mineral-tanned leathers are suitable for thin flexible work, which are not subjected to rubbing against rough objects, and which require to have some great excellence of finish. The vegetable-tanned leathers provide us with material for heavy and rough work; from them we get brown calf for walking boots, and heavy kips, splits, and neats, for navvy boots, sewer boots, and army boots. For details of the production of these leathers, see "Leather Manufacture."

The skins which make the finest leather reach our manufacturers either dried, salted, or preserved by some chemicals; these are soaked and got back to the condition of a freshly flayed skin, before the actual operation of leather manufacture commences. A very large number of small skins reach us partly tanned; these cannot be made into the highest class upper stock, but have to be manufactured on some system of combined tannages. By this we have developed the dongola system of tanning, which is a combination of two tannages. We have also methods of re-tanning, which, while keeping the original character of the leather, give a surface imitation by some other tannage of a better class. A very large number of low grade glacè's are produced in this way.

These partly tanned leethers are described as being in the crust, and are delivered in bundles. They are usually tanned just sufficiently to save them from decomposition, and are generally much improved by being throughly soaked and re-tanned. The skins of small Indian cattle are sent here under the name of kips; they are skins of full-grown beasts, which are naturally very small, and which have the hump in the centre of the shoulder which distinguishes the East Indian kip. These skins are re-tanned and made into very good waxed leathers and imitation box.

The relative strenth of upper leather is shewn at Figure 1. Disregarding the offal which is often very tough, we find that the relative tearing strain is strongest across the ribs; these relative degrees of strength are shewn by the darkened lines, the darkest portions representing the strongest

parts; this shews that the strength is not even over any very large area; that the two sides of the butt are not so strong as the centre; there is a relative weak portion just over the kidneys; and that although the centre of the neck appears to be strong, the skin is weak at each side. The relative substances are shewn at Figure 2; these substances must not be confused with its qualities. The parts of skins which are often of the same substance are not by any means of the same quality. A at the lower end represents the best portion of the skin; it is the stoutest and the highest in quality. B is the second substance. C, the shanks and the middle, which is often of excellent quality, but is rather lighter than A. D is the shoulder and fore-shanks, and comes naturally next in substance and generally in quality. It will be observed that the corners of the neck are also marked A; these are sometimes as stout as the centre portions, but not by any means so good. In some classes of leather the manufacturers have the corners of the neck shaved down; this is not always an advantage; this part being naturally poor and coarse; if it is shaved very thin it gives way. The shanks and the belly middle vary in their substance in different classes of skins, as explained elsewhere.

The value of upper stock is largely affected by its shape; a well-grown skin is naturally squarer, and has a larger proportion of good material in it than the skins from animals in poor condition—Figures 3, 4, Plate 44, represent two types of skins. Figure 4 is a square short skin, the actual available cutting surface being shewn by a clear space, the relative amount of offal is represented by the darkened edges. Figure 3 represents another type of skin, relatively long and narrow, with a large amount of offal and narrow cutting space. The relative shape of the offal and clear good leather is shewn as in the previous Diagram. It will be observed that the shanks are much longer, but the tail is left foul; that the neck and belly is left wider, and that we should, if this skin was bought by measurement, be purchasing nearly half offal.

The lines of tightness are shewn at Figures 6 and 7. Figure 6 represents the direction in which the skins are tight in ordinary cattle. It will be observed that these lines are in curves from the centre towards the shanks, and from the centre of the neck towards the sides. Observation will shew that this is the way in which the hair lies smooth in most four-footed animals, and there is very little doubt but that the cause of the skin being tighter in that direction than across it, is largely caused by the presence of the hair muscles which lie in the same direction as the root of the hair. Figure 7 represents the lines in tightness in a seal skin; it will be noticed that the lines run from the flippers round the butt, in a similar way to the manner in which the skins of four-footed animals are tight. These principles as to the directions of the lines of tightness are constant for all classes of skins, and apply to all classes of leather. It sometimes happens that the process of tanning and dressing practically disguises the lines of tightness. Where the leather is split and the hair sheaths are cut away, the leather shews few signs of any particular lines of tightness. Some stuffings, as paraffin wax, adds to the stiffness of the leather so much, that the directions of the lines of tightness may be disregarded. But in all classes of work that has any claims to quality, the direction of the lines of tightness should be an important matter to the cutter of upper stock.

The finished upper should be tight in the direction in which it has the most strain in the process of manufacture, seeing that the parts are all cut to produce a definite design to a certain proportion; if the parts that are subjected to great strain are in any way loose or liable to stretch, the upper is pulled out of shape. For instance, if vamps or goloshes are cut loose to the toe without any provision for holding the material, when the laster pulls the top-cap, it is highly probable that he will pull it too far over the toe, and thus make it unduly short. If the companion upper is not also loose,

or in the same degree, the result will be that toe-caps of unequal height will be produced. Where it is not possible, for reasons of economy, to cut the material tight to the toe, a special support, in the form of a long side-lining should be stitched in to the upper ; this long side-lining should come from the stiffening round to the draft point of the cap. It is a very good plan to have the side-lining stitched in with the back goloshes in men's work ; this will help to hold up the sides of the boot, and will also keep it tight to toe.

The leather used in the uppers of boots and shoes is generally produced from the skins of lambs, sheep, goat, kid, calf, and oxen. In addition to these, the horse, seal, kangaroo, pig, and white whale, are used. As a matter of fact, almost any skin that is large enough to be profitably tanned is used for some purpose. Pig skins for leggings, lizard and crocodile, and at times large quantities of dog skins.

A lamb skin is the skin of the animal before it has cast its first wool ; the hair sheaths of the second growth producing an entirely fresh effect upon the skin, and although it may be still very fine and soft, it cannot be regarded as a lamb skin. Sheep skins are of a great variety of size and texture ; some of them, as our domestic sheep, having a peculiar open soft fibre ; the distinctive peculiarity of the sheep skin is the excessive looseness of the flanks and a tendency for the two outer surfaces to separate. In addition to this, the wool and the grain formed by them have a different form and a more ragged appearance than the grain formed by the hair sheaths of a goat.

Persian sheep which live in a dry atmosphere and which have to travel long distances and climb for their food, have a stronger, shorter and tougher wool, more like the hair of a goat than our domestic sheep. The skin partakes of the nature of its wool ; it is very similar to a goat skin, but coarser, looser in the fibre, more liable to tear, and with the peculiar characteristics as to splitting.

Smyrna sheep skins have some of the characteristics of the ordinary sheep skin and of the Persian sheep. They are softer than Persian, but less mellow than our own ; they do not make good imitation goats as the Persians, or quite such soft leathers as our sheep or lambs. The kid skin is the skin of the young goat before casting its first coat. It is unquestionably the best material for making the finest leathers for uppers of shoe wear, but enormous quantities of fully-grown goats are sold as kid skins ; there is quite as much variety between the classes of these skins as there is between the true kid skin and goats.

A large proportion of our supply comes from India, the largest market being at Patna ; these skins have a very high repute, so high that the number of skins sold as Patna skins is many times larger than the number grown. The typical skin itself is a short-necked, light-shanked, fine-grown skin, but the quality varies greatly ; it is manufactured into the highest class of work. We have also large quantities of similar skins from China. The ordinary goat skin which is manufactured into leather sold as kid skins, has a fine range of size and quality. The shape of the skin varies very much, but a representation of the largest, coarsest and least profitable shape is shewn, at Figure 3, Plate 44. It is a truism in connection with these classes of leather, that the price per foot is but a small indication of the relative probable cost of the cut stock ; some skins are so badly marked by thorn scratches ; have such a bad shape, and have so much offal, that they are dearer in the cutting room than better quality skins at a much higher price per foot.

Precisely what a calf skin is, has been the subject of hot disputes, but there cannot be much doubt that a calf skin is supposed to be the skin of an animal before it is permanently taken from the cow, seeing that in some parts of Norfolk the calf is kept with the cow until about eighteen months old, this is a sufficiently elastic description, a fair age would be up to about nine months old. From that age until two years of age, the skin should be referred to as a "neat"; above that age, they are ox or heifer hides. Usually speaking, the calf is killed before nine months' old, for veal; it is not profitable to kill it between that age and two years or two-and-a-half years; usually, it is killed about three years of age, for beef; but recently, although the flesh has been sold for beef, the skin has been sold for calf, or at least for "neats." Above three years of age, we have ox hides and cow hides. When the heifer or cow is killed so young as this, the skin is exceedingly fine, plump along the centre and thin in the offal; at a greater age, ten or twelve years, the skin becomes poor, veiny, and distended all over.

There is a distinct difference in character between the male and female skin, which becomes more marked with the age of the animal. Most small finished calf skins are females, because the males are kept for beef, and the females that are raised are kept for cows, and killed at a much greater age. It is generally considered that the female skin is one quality higher than the male skin, *i.e.*, a second quality female skin is about equal to a first quality male, assuming both to be sorted separately. This only applies to calf skins. In the larger type of skins there is a less proportion of female skins, most of them being the skins of oxen.

Figure 5 represents the different qualities of the parts. A is referred to as the butt: it reaches from the lower edge to about the middle of the skin, beyond that until level with the shoulder as B is called the middle, the next is the shoulder which reaches up to the neck. The side of the neck is the gullet. The line from the gullet down to the butt cuts off the belly on the side as EDF. F is the fore shank; D the belly middle; E the hind shank.

The butt is unquestionably the best portion of the skin, although it may vary very much in its different parts; this variation is largely affected by the manner in which the belly is trimmed off, and as stated when referring to Figure 3, by the shape of the skin. The middle of the skin contains probably the finest leather, although in male coarse skins there are very often growth marks across the ribs. The shoulder varies with the growth of the skin, it may be very thin and fine, or very thin and poor. The belly also varies with the class of skin; in some cases the belly is relatively stout, while the centre of the skin is relatively light; the shanks, and the possibility of using them up for outsides, vary with the class, the method of tannage, and the style of dressing. If they are well set out, that is to say, if the stretch has been taken out across the shank, and they are free from creases and are not very poor, they may sometimes be utilised as shewn upon Plates 49 and 50.

Figure 6 represents a kip butt. A kip butt is generally the best portion from the skin of small Indian cattle; the round mark upon the diagram represents a weak place generally found in them; it is the position of the hip bone; this has to be avoided in cutting, as shewn upon Plate 51. A side is half of the entire skin or pelt cut down the centre, as Figure 9. Naturally, as this contains the half of a complete skin, it varies in its qualities and substances, as described in reference to Figures 2 and 5.

Figure 10 is a crupp butt. This is cut from a skin of a horse or quagga, from the part marked A, Figure 5. Upon this being cut out from the horse hide the portions beyond it are dressed

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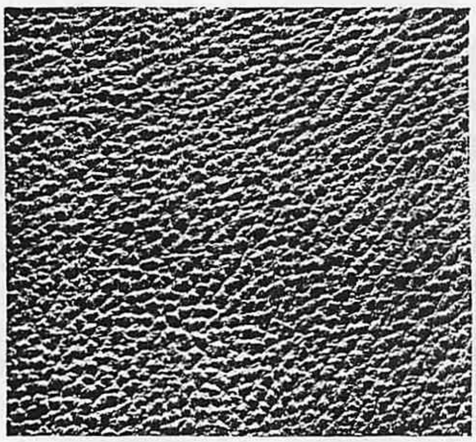
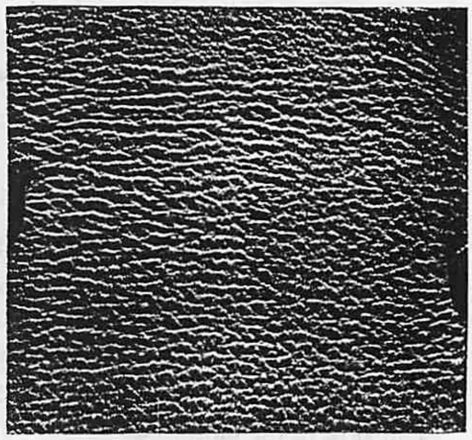
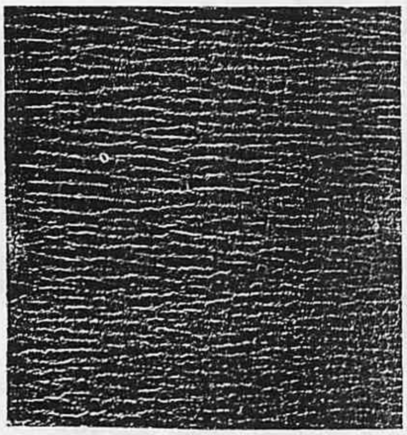


1. Natural Grain.

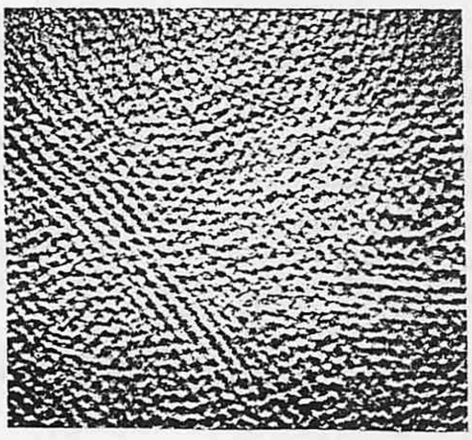


2.—Pebble Grain.

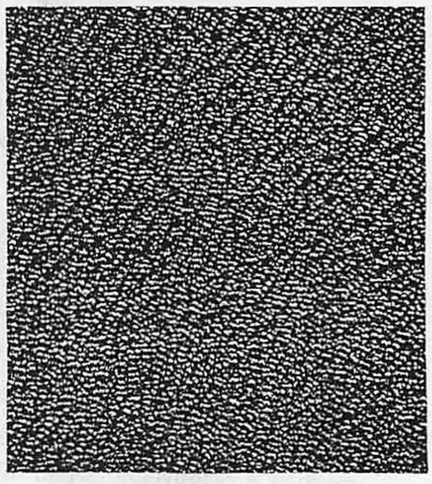


3 Morocco Straight Grain.

4.—Shot Grain.



5.—Grain Patent.



6.—Seal.

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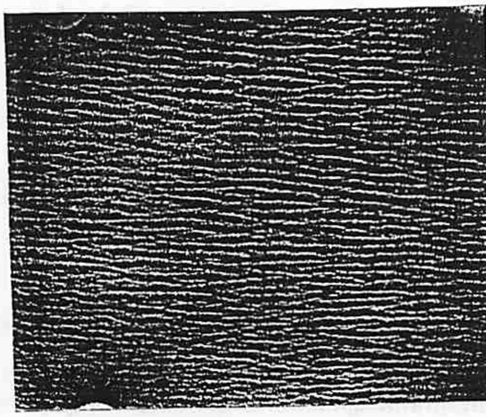
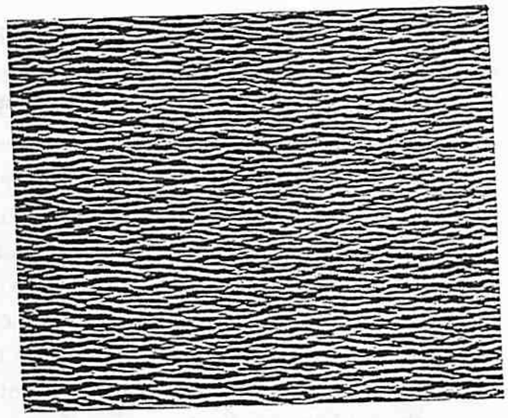
Plate 46.

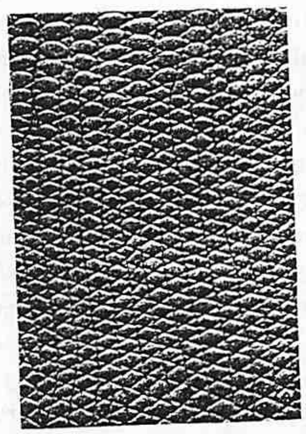


1.—Natural Boarded Grain.

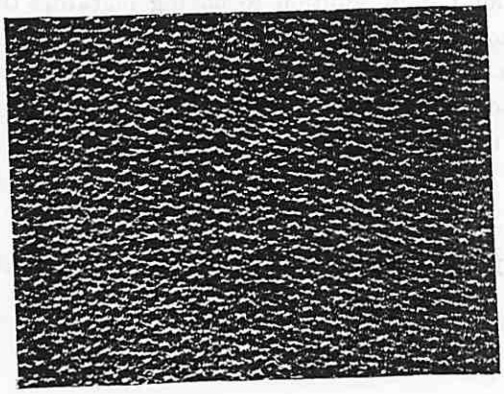


2.—Machine Grain.

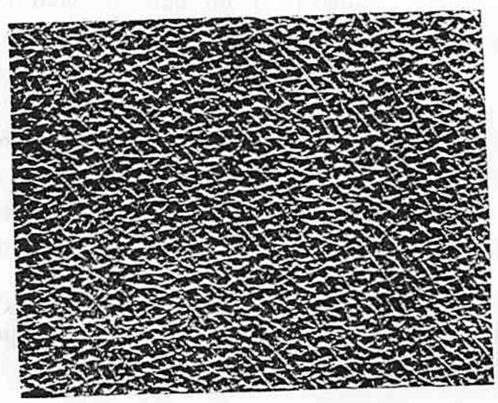
3.—Crocodile.



4.—Imitation Leopard.



5.—Natural Pig Grain.



6.—Imitation Pig.

into cordovan. Very many of these crupps are taken from branded horse hides, and are marked in various ways on one side of the butt in a similar manner to the markings upon Figure 10.—See Leather Manufacture.

Plates 45 and 46 represent the different grains that are produced upon the finished leather. Figure 1 is the natural grain as seen upon the back of the waxed calf skin, or upon the face of a leather that has not been artificially treated for the production of a certain grain. Figure 2 is a pebble grain produced by rolling the leather in two directions ; the rolling is commenced at an angle of about 45 degrees with the back bone, by folding the leather down and rolling it by the pressure of a board, this accentuates the grain in the direction of the fold ; this is continued all over the skin, it is then folded upon the opposite side of the skin with the angle towards the back bone, and the operation repeated ; this throws up a strongly marked grain, as Figure 2. Where a square, pebble, or shot grain is wanted, the rolling is carried straight up the skin and straight across, producing a square grain. A very round grain or shot grain, is produced by additional rollings at angles as mentioned in the first case. A grain in one direction in straight lines across the skin, is produced by rolling with the fold in the direction that the grain is wanted ; this straight grain, sometimes called a Morocco grain, is shewn at Figure 3 ; the shot grain at Figure 4. After the rolling, grain calfs and hides are sometimes japanned, producing what may be called a grain patent leather, this effect is shewn at Figure 5. Some leathers produce natural grains that are very difficult to imitate. The seal grain is shewn at Figure 6. This grain consists of a number of granular-like spaces with rather pronounced vein markings. The natural grains are very generally referred to as boarded grains. Artificial grains, machine or stamped grains, are distinguished by great regularity in the markings ; they are produced by the engraving of a cylinder, and naturally consist of repetition of precisely the same markings. These precise markings are rarely found in natural boarded grains ; the two distinct types of grains are contrasted at Figures 1 and 2, Plate 46. Figure 1 is a straight natural boarded grain. Figure 2 is a machine-made or stamped grain, which is really produced by the impressions of a roller. The difference between them is quite distinct, although somewhat difficult to express in words. Figures 3 and 4 are other examples of natural and imitation grains. Figure 3 is a photograph of a portion of a small crocodile skin. It will be observed that although the markings are very distinct and very similar to one another, they are by no means precisely alike, in fact there are no two markings which are in every way the same. Figure 4 represents a machine-made grain which is supposed to represent a lizard grain. In this case the markings are evidently mechanical, the very similarity and regularity of them indicating that they have been produced artificially. Figures 5 and 6 are representations of natural and artificial pig grains. The remarks made in reference to the other grains apply to this. Figure 5 shews the holes made by the bristles ; these holes commonly go quite through the pig skin, and form the distinguishing feature of this particular leather. Bristles quite distinct from hair or wool have the sheaths very deeply buried, and when they are taken from the pelt, leave the bristle holes quite through it. The imitation pig, in addition to having markings that are mechanically perfect, have larger surface or grain holes representing the bristle holes, and these holes do not go quite through, they are simply stampings. Some very fine grains which have a very natural appearance are produced by a combination method. A portion of the natural grain is scoured off the skin, it is then passed through a roller which has nearly the kind of grain required, and it is then boarded up as in a true hand-made grain. The result of this is, that a fine grain may be produced upon a large coarse skin.

Systems for cutting upper stock may refer to a systematic repetition of an arrangement of the parts in some order that will produce the closest method of cutting, and therefore the least amount of

material not actually cut into the parts of the upper; or it may refer to an arrangement of the patterns on the materials in some general order that may be systematic without much actual repetition. It must be evident that it would not be economical if a large proportion of the cut stuff was unsuitable for the purpose it was intended for, and therefore as most leathers are not large enough in their surface to allow of a great many repetitions of the same arrangement, very much skill and judgment has to be displayed on the cutting of upper material.

But in some cases there are reasons for the closest methods being used, and these methods are undoubtedly those which include a system of cutting. Specimens of some of the methods are shewn on Plate 47.

Figure 1 represents a method of cutting whole golosh vamps; it is a condition of this method that the goloshes must be cut to lock in, and that there be sufficient space on the material to allow of several repetitions of the system. The locked-in vamps are arranged in reference to a straight line upon the material. This line is generally along the bottom edge, but may be represented by the lines A B or A C or B D. If the line A B was used, the first pattern would be put down so that when the goloshes were locked in, the toe of the next vamp along the line would fit in the space between the side of the vamp above it and the end of the golosh first cut out. The cutter must use some judgment in this matter; the vamp has generally to be placed a little above, or a little below the line to permit of the next pattern fitting in to the best advantage. The principle upon which goloshes are arranged in system is also illustrated on Figure 2; the application to practice in cutting a skin on Plate 50, Figure 1. By this illustration we see that the centre arrangement had in this case to be modified; the tail end of the backbone was not good, and there was not room to get a complete vamp in the centre; therefore the system was carried round the place unsuitable, and continued up the skin.

Figure 2, Plate 47, shews the application to a whole golosh, the method is very similar to that for pieced goloshes and the remarks apply equally; of course the pattern takes up more space, and is very difficult to arrange on a small skin. If the skin is very small, as Figure 6, Plate 49, the method has to be abandoned and a system used as shewn.

Leg patterns naturally lend themselves to orderly arrangement—Figures 3, 4, 5 and 6 illustrate methods of cutting these parts. Figure 3 is the one-side instep to instep method. The line usually drawn or worked to is the line A C or A2 C2. A row having been cut to this, the next row is taken—the two bottom edges together and the back seams touching; in some cases whole skins are cut in this manner, the first line being taken across, up the backbone, or diagonally. Figure 4 is a system to face—that is which produces pairs as they are cut. It is a toe to throat system to pair up, and is worked in any direction in relation to the skin, as are the other systems. The line A B is the starting line; the line A C is much squarer to A B than in the other systems, and therefore the method may be started straight across the skin and continued up the sides.

It will be observed that the lines cut off certain portions of the outlines of the patterns; if these are carefully noted, it will be found that the amount is, in each case, equalled on the other side, that is, the amounts cut off the top of the leg of the patterns, along the line A B, Figure 3, are left on along the line C D, and therefore, there are eight backs in this space. If we multiply A B by C d, we shall have the number of square inches in the space. Of course, the spaces cut off must always be provided for on the other side. If the measurement was taken from A, it would be to B, not to B2, because the space above A B should be occupied by the toes of the quarters fitting into them.

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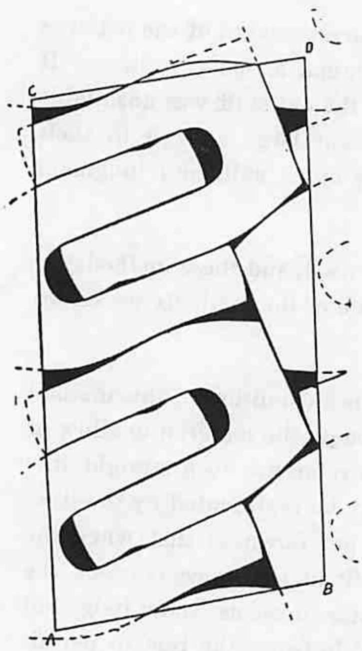
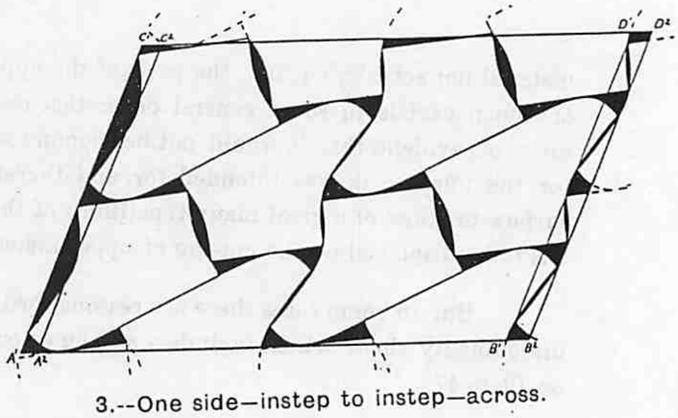
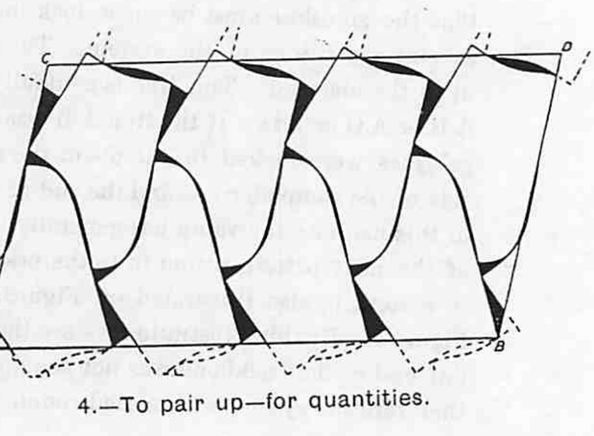
Plate 47.



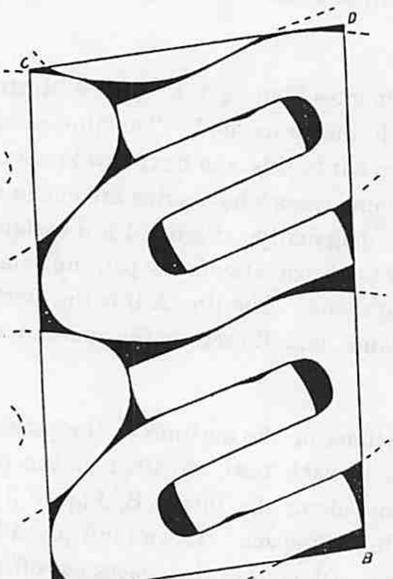
1.—Locked-in Goloshes—
toe off.



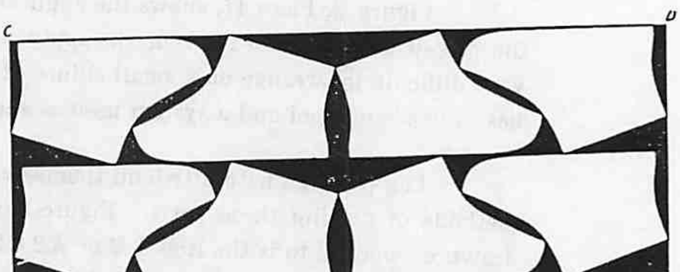
3.—One side—instep to instep—across.



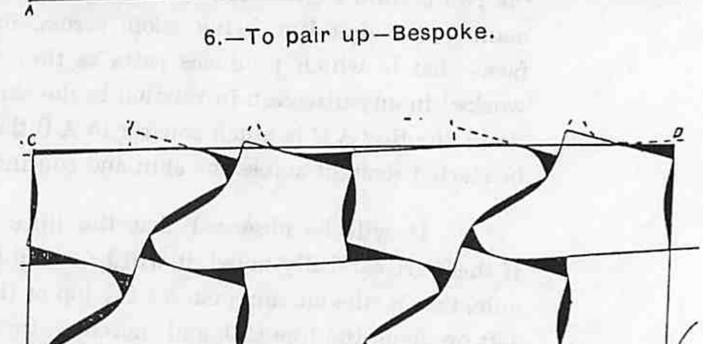
4.—To pair up—for quantities.



2.—Locked-in Goloshes—
toe on.



6.—To pair up—Bespoke.



5.—One side—straight system.

Systems and Areas.

This is also shewn on Figures 4 and 5, although there are less amounts than in the first case. To determine the area taken to cut the eight quarters—two pairs, we will assume that in Figure 3, A B measures 20 inches and that B C measures 12 inches; we know that there are 144 inches in a square foot; we therefore say, 20 multiplied by 12 and divided by 144, will be the space covered by the two pairs of legs; that is equal to one foot and 2/3rds.

Figure 5 is a toe to throat one side system, it is very easily worked, and a good method where the throat of the patterns is rather sharp, but too wasteful for full-throated patterns. Figure 6 is a method to pair up; this is the best method when the order is for a small number, and particularly for single pairs. The centre of the diagram represents the backbone, they are usually cut in this way at the bottom of the skin, and then cut with the bottom of the leg towards the back bone, for the next pairs.

Naturally, there is a difference in the results of these methods. Figures 1 and 2 are about equal in the matter of economy, allowing for the space taken off by the toe joiner in Figure 1. Figures 3 and 4 are the most commonly used methods for ordinary work; of the two, Figure 4 takes up the less space. Figure 5, as explained before, is for low leg sharp throated patterns. Figure 6 is certainly most expensive for quantities—it should only be used for bespoke or for very high-class work, that must be matched in colour and substance. For this purpose it is a good system; the two centre legs having their back seams to the backbone, are perfectly arranged for coloured work; the two outer ones, with the back from the backbone, are in the direction of the darkest part of the skin, but still match in colour. Precisely similar systems are in use for ladies' work, and the same principles are applied; the only variation being that the shape of the patterns being different, the application varies in the arrangement.

Linings are cut out of various materials—woven stuff, as linen, jute and cotton, russet calf (which are simply light unwaxed calf skins), the offal from waxed calf skins, specially prepared imitations of russet calf, and a large number of low quality skins specially prepared for linings. Probably the best lining for shoe wear is a good linen lining; it is the coolest to the foot; the quickest to dry if it gets wet, and the lowest cost. Leather linings which have become fashionable of late years form a very good support for a heavy class of boot. For work which it is desirable to make watertight, the leather lining is unquestionably the best, from the fact that it absorbs and retains grease in precisely the same way as the outside; and as the greasy matter added to the leather is the best waterproofing agent, the leather-lined boot is more easily made waterproof than a linen-lined.

A great many leathers are used for linings which are very ornamental; in some cases they are exceedingly soft and stretchy. These very soft linings do not form a good support for the shoe, and require to be backed up by some inter-lining to make good-looking shoes. In most cases a very soft, stretchy lining either pulls tighter than the outside, or it is loose and baggy when the shoe is made.

Linings cut from fabrics are usually cut as Figure 1, Plate 48. The line A B represents the commencement of the material; the back seam of the patterns is arranged towards this line, as 1, 2, 3. The next row is taken like 4, 5, 6; this is one of the simplest systems, and it will be seen that the toe of the first pattern must be so arranged that the leg of the one above it touches the line A D. This would be produced by shifting the heel of the pattern until the toe was the correct pitch. The linings 4, 5, 6, naturally touch and drop into the first row. These are represented as exactly fitting the width

A B, which rarely happens. If the width of the material was a little wider, it would be advisable to draw the lower row of patterns a little further apart, so as to utilize the space across the material; this would permit of 4, 5, 6 being placed lower down, thus saving in the length some of the waste made in the width. If the width was very much wider, but still not wide enough to take another lining across with the toe up, it is advisable to drop the next one down, as 7; this would be repeated in the next row, it would then be found that the linings would come straight across the material each third row. It is advisable to cut some woven materials with the toe across, as Figure 2, for the purpose of getting the warp threads across the width of the boot. The object of this is to prevent the strands pulling in the process of making, and is a fairly general custom with fancy fabrics that have a toe-cap. Where there is no toe-cap it is usual to cut them with the warps from toe to heel. The arrangement 1, 2, 3, 4 shews the usual arrangement where the width is suitable; a similar modification is made as that mentioned in reference to Figure 1. In this case the second row will be arranged as 5, 6, 7, which would accommodate a width of material as A C. Linen vamp linings are cut as Figure 3. Some cutters prefer to work across the material as A B, others to work up the material as the dotted vamps A B 2. The strongest threads being along the length of the material would make the vamp linings strongest across the width, if cut from A to B; and strongest in the length if cut from A to B 2.

The materials for linings should be carefully selected. If the closing is to be done upon a bag method or any system that requires the material to be stretched into place, the lining leather should be close, fairly light, and not loose. If part of the material is stretchy, it will draw out of shape during the bagging operation, and badly fitting linings will be the result. These loose parts should be selected for vamp linings or for work that is trimmed off raw edge. Although a loose leather will never trim cleanly, it will be far better as a trimmed edge than as a bagged edge.

It is a common fault in leather-lined boots that the parts do not match for substance, and consequently a great deal of irregularity is produced in the outline of the boot; this might be remedied by the use of a good splitting machine, through which all parts which are intended to come together in the boot should pass. This question of splitting is a very important one in connection with the selection of material for the inside fittings. All inside facings, stays, back leathers, and top-bands, cut from leathers of various substances, should be skived down to one uniform substance. This skiving may be done when the leather is in the rough, or in the cut section. In leathers that are a fair size, and fairly flat as well, it is advisable to skive the material in the machine. Where the pieces are small and not flat, it is sometimes better to skive the cut fittings; in any case, the parts must be reduced to an even substance.

Leather linings have to be cut in a similar way to outsides, but as they are usually cut from inferior skins and pieces, systems have to be modified to suit the shape of the material. Figure 4 shews a method of cutting these linings; this may be worked alternately with the methods shewn at Figures 1 and 2. Generally, a leather lining is joined across the line A B, Figure 4, in which case we have two pieces, as Figures 5 and 6. Figure 5 represents the usual method of working backs upon a system very similar to Figure 3, Plate 50. This method would be worked as far as practicable in the centre of the skin, the awkward places and shanks being used up for the toe ends, as Figure 6. Where the backs are cut from large materials, as sides or kips, the system shewn at Figure 5 may be worked along the backbone, and in the case where the vamp linings are cut from light splits or other large offal, the system shewn at Figure 6 may be used.

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Plate 48.

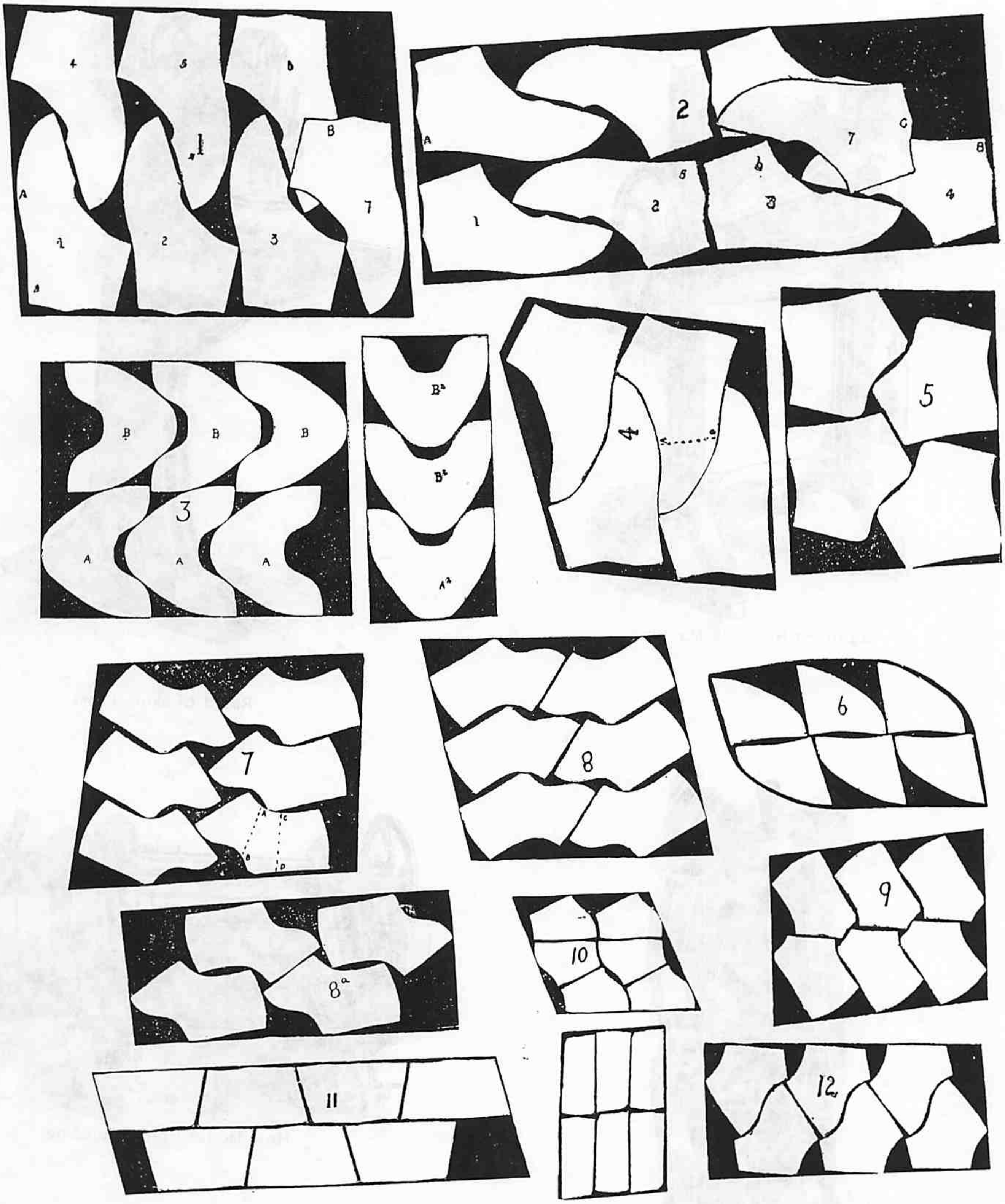

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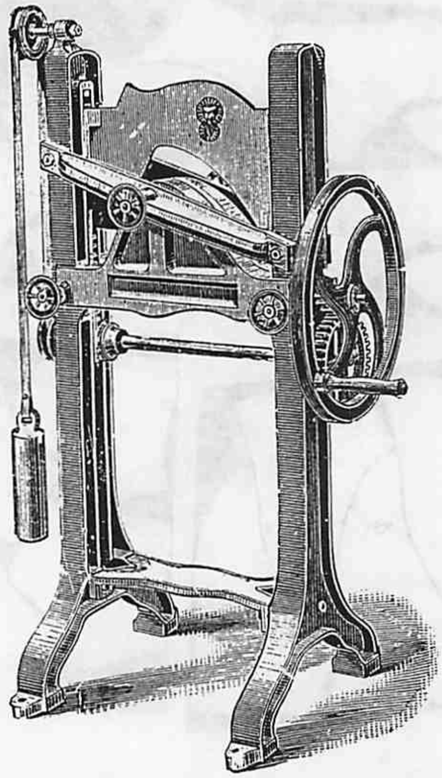
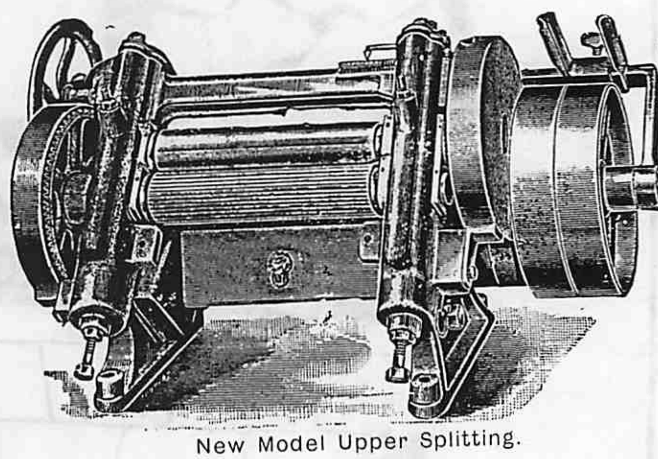
Plate 48a.



Standard Blocking Machine.

Radid Clicking Press.

Sole and Upper
Cutting Knives.



New Model Upper Splitting.

Cutting, Splitting, and Blocking Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

Shoe linings are cut whole, as Figure 7, or in sections, as the line AB, or whole-backed, as the line CD, EF. Where they are cut in one piece they may be arranged upon a system as Figure 7 ; this produces pairs, and is generally referred to as the toe to instep method to match ; it is a very practical system for small numbers where the material is not very large, and it is desirable to pair up as the work is cut. Figure 8 is another system for cutting the same backs ; it produces backs all for one side, and is generally called the vamp edge to vamp edge (one side) system. It is commonly used where large quantities are required of one size, and produced from material that has a considerable cutting area.

Figure 9 represents the method of cutting the pieced backs divided down the line AB. The remarks concerning the leather linings, when referring to Figures 5 and 6, apply to this matter.

Figure 10 represents the system of cutting the front piece, usually, these small pieces are worked in to cut up the corners of the flanks, shanks, or edges.

Figure 11 represents the whole cut shoe back, which is joined across the side as CD ; they are very easily cut from large surfaces.

Figure 12 is a system for cutting the other portion of the lining.

The whole of the diagrams shewn upon Plates 47 and 48, illustrate the repetition of arrangements which are generally referred to as systems. Probably the best example is shewn on Figure 1. The absolute regularity of the surface of lining and its positive width permits of a mechanical arrangement or repetition which ordinary skins do not allow.

Although these mechanical repetitions are not always possible when cutting skins, the practical clicker should be acquainted with them as they contain the underlying principles which he applies in cutting leather of irregular surface. There are only a limited number of possible arrangements upon any surface—upper patterns generally having about three possible different repetitions ; if the clicker is acquainted with these he can easily select that which is most suitable for the particular material to be cut ; if he is not sure that he knows all the possible arrangements he will probably lose time in endeavouring to invent some fresh system or mechanical repetition in the arrangement of the pattern. In some cases, as in goloshes or whole cut vamps, there is really only two arrangements possible : the vamp is either arranged to lock in as Figure 1, Plate 50, or is arranged across the skin as Figure 7.

Upper stock may be cut into one quality only, or may be sorted and cut and used for several qualities, according to its nature and class of trade. Even where there is only one quality to be considered, it is advisable to sort for substance, seeing that the different parts of the uppers require different substances of material. There can be no question but the strongest part of the leather should generally be put in the vamp portion of the boot. For heavy digging boots, the toe portion should be of first-class material. The back counter also should be good. In lighter classes of work where the toe-cap is backed up with strong toe-boxes, the cap itself should be fine, tight, and tough. Boots that are subjected to rough weather should have the tongues cut out of strong material. In some heavy classes of work used in climates where there is a great deal of sand, there is an enormous amount of friction between the laces up the boots and the tongues, which very quickly wears the tongues

through. All parts that are subjected to strain of the fastening, such as the facing of a lace boot or the fly of a button boot, or the strap of a barred shoe, should either be of first-class material, or should be stayed to withstand the strain.

It is the general custom to put the stoutest material in the larger sizes, but this scarcely bears a consideration from a common-sense point of view. Seeing that the purchaser of the large size pays the same price as the purchaser of the small size, and that he is receiving the larger amount of area in material, he can scarcely be considered to be entitled to have the greater amount of substance. As a question of relative values, that is, assuming that each customer has the same value for their money, all shoes of one class, make, and price, should weigh precisely the same. If we put the stoutest materials in the larger sizes, this could not happen. However, it is the trade custom to sort the stoutest stuff for the largest size, and it is not advisable to depart from that custom.

The leather should certainly be sorted into qualities. The stock-keeper would sort them into several qualities, giving each quality out for the purpose it is suitable for. The stock-cutter, if expected to cut entire uppers from his stock, should first sort into about three qualities. His first higher qualities would be cut with a view to producing those parts that require to be of the best material. Having produced the desired number of these, and worked in the other parts as was convenient, he would proceed to cut the lower quality parts from the lower quality skins he would have in hand.

All coloured leathers have a tendency to be darker in shade in the inferior parts; the softer, coarser and more open texture of the offal appears to absorb more colouring matter than the finer parts, and consequently, the edges of coloured skins are usually dark. There is also a considerable variation in the actual shade of skins. The power to absorb dye being different between individual skins, there is always a variation in the shade in one lot. These should first be sorted for shades, then for quality, each shade being sorted in the same manner as a large quantity of black skins, and cut upon the same principle. In the actual placing of the patterns upon coloured leather, it is desirable that similar shades should come together in the finished boot, and as the vamps are cut out of the centre of the skin, all parts that meet the vamps should be cut towards the middle of the skin, as near as possible.

The strain that leather is subjected to in lasting naturally opens the grain, and this causes coloured leathers to become lighter over the surface of the strain; consequently the toe-caps in light coloured often appear much lighter in the shade than the other parts. To remedy this as much as possible, the caps should be cut from the tightest parts of the skin; certainly tight in the direction of the toe, and also from the parts that are not lighter in shade than the average colour of the vamps.

Some distinction must be made in the method of selecting and cutting different classes of leather. Those which are finished on the grain side as glacé kids, box calf, russet calf, and calf kids, naturally have thorn marks or scratches on the face of the leather and flesh cuts upon the back. It is advisable to indicate the position of bad flesh cuts by pinching the parts between thumb and finger: this will shew clearly upon the face without there being any need for pricking through or marking. Where the finish is on the flesh side as in waxed leathers, the flesh cuts are naturally on the face; these are sometimes finished down very closely so that it is necessary to go carefully over the skin to discover the cuts. In waxed calf and other leathers it is usual to scrape out very light

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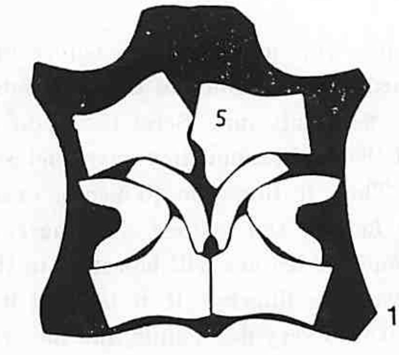
Plate 49.



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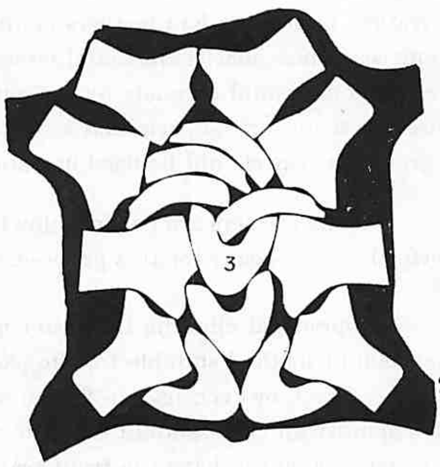

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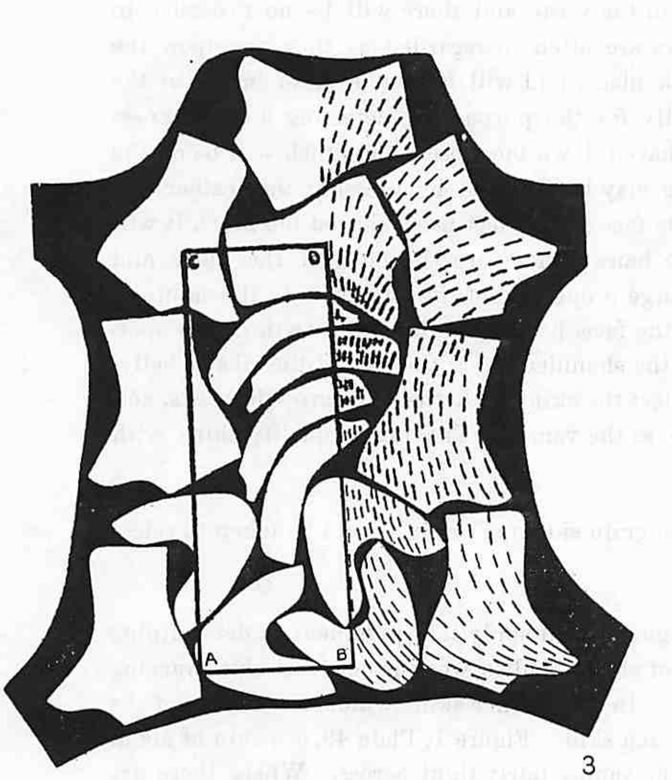

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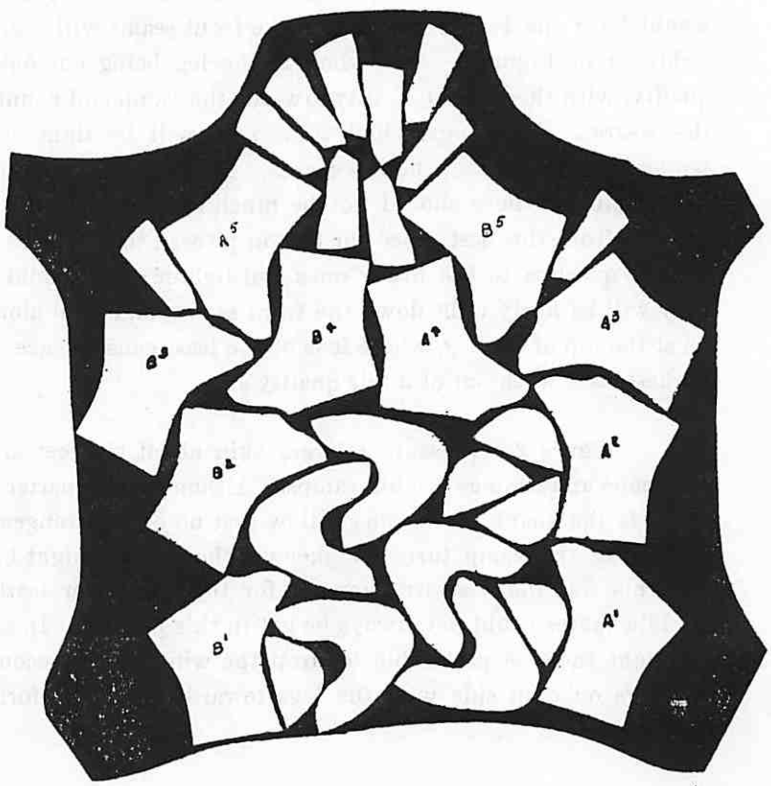

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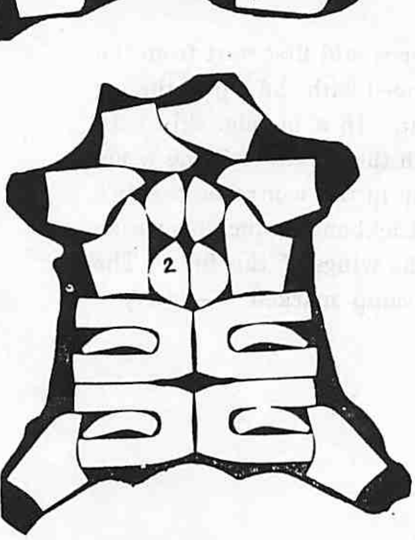


6

flesh cuts: this may be done before or after cutting the material; it is rather preferable to do it afterwards, because some of the flesh cuts may be cut in the waste and there will be no necessity to buff the flesh cuts out. Scratches upon waxed leathers are often disregarded as they are upon the back of the leather, but they nevertheless form a weak place, and will be the first to break in the wear. These leathers should also be examined carefully for the purpose of detecting any weakness on the face of the leather. If the skin has been shaved down too closely the finish will be on the fibres, and the leather will be rotten in the wear: this may be detected by pressing the leather upwards with the fingers; if it is good it will retain its face; if it has been shaved too much it will open out into very fine points like the ends of minute hairs; these are the ends of the fibres, and although they may be waxed up to look very well, a large proportion of the toughness in the nature of the leather is gone. Kid leathers being finished on the face, have generally the growth marks upon the surface: these marks are found across the neck in the shoulder and at the side of the ribs or belly. An endeavour should be made by the cutter first to select the skins with the least growth marks, and to use these up for the parts that are most often seen, as the vamps. The lower quality skins with the growth marks should be used up into backs.

Patent leathers are cut face down, *i.e.*, with the grain side up; care should be taken to select a perfectly clean board for this purpose.

In practical clicking the cutter must have judgment, and apply that judgment in determining the system or method suitable for the particular kind of skin. Ladies' work is cut from skins varying from three feet, or even less, to fifteen or twenty feet. In the smaller skins which are usually of the higher quality an effort should be made to pair up in each skin. Figure 1, Plate 49, is a skin of about three feet area, cut to have the front seams tight and the vamps fairly tight across. Where there are no toe-caps to the work as in this case, it is an advantage for the vamps to be tight across, as they retain their shape better in the wear. The first two backs cut with the back seam to the bottom edge would have the back seams tight; the front seams will also be tight as is evident from the lines of tightness in Figure 3. Th whole of the leg being cut out of fairly solid stuff will be of a high quality, with the highest o. .lity towards the vamp and counter—as it should be for the best results to the wearer. The vamps which come next will be tight along the wing on one side, but have a tendency to be weak at the top corner. Much will depend on the quality of the skin, but in a skin of this trimming there should not be much trouble about the wing of these vamps. The button pieces are cut from the best place for button pieces; they will be tight and fine. The two top quarters are similar quarters to the lower ones, but lighter; they could very well be put into the inside quarter; they will be fairly tight down the front seams, and tight along the counter; the only weak place will be at the top of the leg, where it is of the least consequence. This represents a fair arrangement for highest class work out of a fair quality skin.

Figure 2 represents a larger skin about six feet area. The cutter would first start from the backbone and arrange for his vamps. Although the quarter has been arranged with the top of the leg towards the shank, it does not follow that no other arrangement would suit. In a broader skin with the toe of the vamp turned higher up, the quarter might be arranged with the toe towards the wing, but this was the best arrangement for this particular leather. The vamp in the centre of the two middle vamps could not always be got in this position. In some cases the backbone is much too weak; it might then be preferable to drop the wings of the second vamp into the wings of the first. The quarters on each side with the legs towards the belly, form—with the vamp marked 3—nearly a

straight line across the skin. The practical cutter generally finds it is an advantage to work somewhat in that way, so that he produces as he goes on a succession of working edges. With this comparatively straight line the arrangement for the rest of the skin becomes rather simple ; the button pieces are worked in across the shoulder—the best place for them—the other four legs are arranged to match towards the shank and neck. This was the best arrangement for this particular skin, but must not be accepted as being the "ideal" for every skin of the same kind. It is simply a practical working solution of the problem in cutting presented under one circumstance. The offal that is left should be worked up into button-piece linings, top-bands and stays.

Figure 3 represents a skin of about the same size but different in shape, and it also represents a method of cutting rather different to the foregoing. The object being obviously to put the best of the material into vamps, button pieces, and the parts most requiring it, and at the same time, as near as possible, to have the uppers to pull tight to toe ; some arrangement that will produce a combination of these results, is the most desirable. At the same time it must be evident that it is not practically possible to cut work absolutely tight to toe and at the same time be economical. The rectangle A B C D, Figure 3, represents the best part of the skin ; this would be repeated upon the other side of the backbone. The direction of the lines shew the way in which the skin is tight. The first vamps are arranged to lock in the wings ; the next vamp on the lower edge fix into the vacant wing of the lower vamp just cut. Fitting against the point A, a quarter is cut that is intended for the outer side, so that the loose portion near to the flank may go underneath the button fly. A vamp is fitted into the top corner of this quarter. Upon the opposite side, another quarter is cut to match it. This leaves a comparatively straight working line, as in the previous skin. The two next quarters are arranged at the edge, the button pieces being fitted into the space between, in the best places for them, and tight across ; this produces the next working edge. Into that the four legs are arranged as closely as possible. Objection may be made to some of these quarters ; it is found in practice that for ordinary work a skin of this class must be cut quite as close as this example. An alternate arrangement might be made by turning the corner of the quarter on the right-hand side towards the middle of the skin ; this would cause it to match the one on the left-hand side. The leg at the extreme top would then be reversed, the front of the quarter being turned down, and the back seam put towards the top edge. Diagramatically, this would be a better arrangement, but in the actual skin it was not possible, because the right-hand shank was scratched, and there was a small flaw where the point of the quarter would have come if it had been turned. This method produces two pairs from this skin, which measured $5\frac{3}{4}$ feet.

Figure 4 represents a tan glacé skin, of fair but not first-class quality ; the edges were rather dark compared with the centre, and it was desirable that pairs should be produced, that all leather suitable for outsides should be utilised, and that the colour should match as near as possible. The first pair of vamps were taken in a very similar manner to Figure 3 ; the next vamp was reversed, the toe being placed on the backbone, this being of no consequenee because it would be covered by a toe-cap. The two quarters A 1, B 1, were then cut to match ; these, with the vamps and caps, form the first working line. The next row consisted of a pair of vamps worked into the best part, three caps cut to be tight, and two legs A 2 B 2, cut with the fronts towards the centre of the skin, and matching in colour and side. We then reach the end of the second row ; we now arrange the remainder of the skin to take the remainder of the legs and the back counters. It will be noticed that at the top end, near the neck, the front of the back counters are cut towards the middle of the

skin, wherever possible; this causes the majority of the back seams to be of the same shade. The roundings of this skin left after cutting, appear to be rather large, but without cutting really bad shoes, this skin could not be cut up any closer. It represented a $6\frac{1}{2}$ feet skin.

A cutter, although arranging his patterns in various ways, should get into the habit of working to a system, he may start from the centre of the skin, at the backbone, or from one of the shanks, the right hand or left hand: but he should get into the habit of systematically considering the particular arrangement required for the peculiar shape of each skin. Generally, it is advisable either to start from a flaw, from the back bone, or from the left hand shank. If the skin is very large and clear, and a system of repetition of arrangement, as previously described and illustrated upon Plate 47, is to be used, then a good plan is to start from the left hand shank, and work straight across the skin. If the skin is to be cut into a combination system of vamps in the centre and legs at the side, then it is generally best to start from the backbone, arranging the first vamps to fit round any flaw that is across the butt. The other part of the system has naturally to be adapted to the line produced.

Figure 5 was a coloured glacé of not very good quality that was to be cut up closely into men's golosh work; they were cut for folded edges and the vamps would not lock in. At the lower edge beside the butt was a large flaw. This skin had to be commenced from the left-hand side, cutting the vamp over the backbone and taking some of the flaw under the toe-cap. The stuff next the shank after the vamp was cut was not good enough for a leg, and therefore it had to be cut into back counters as shewn. The right-hand shank was good enough to take a leg, which permitted another vamp to be fitted over the backbone, keeping clear of the flawed space at the bottom; there was then room for another leg with the top towards the belly, completing the first line across the skin—in this case a rather irregular line. The next operation was to arrange a quarter against the left-hand side, and another vamp with the toe over the backbone. This allowed of the three caps being cut in the shoulder and three legs being arranged round them. The back counters were fitted in the only possible places, and were as much as possible utilized to work up the darker part of the skins; this was a 4 feet skin and represents fairly close cutting.

Figure 6 represents a very good class skin cut as close as possible into whole cut Boston backs. In this case the first essential thing is to secure the vamps. As the skin is not large enough to permit of the vamps being locked in, and the vamps themselves are not wide enough in the wing, the Boston back straps have to be cut inside the wing of the vamp, as shewn. These vamps are first got out, shifting them a little to work in the quarters as closely as possible; the quarter on the right-hand shank fits close under the curve of the vamp. On the left-hand side it was turned up for the front to be inserted in the wing, the lower vamp and the two lower quarters represent the first line; the next quarters and the vamp are cut as close down to it as possible, in each case the loose parts of the flanks being left. The four shanks and neck are now worked up as close as possible, the toe-caps being got from the shoulder and the other legs cut close round it. This skin measured $3\frac{1}{4}$ feet, and is real close cutting. In each of these illustrations actual skins are represented, and the best arrangement for those particular skins. The object has been to illustrate actual specimens of cutting, to serve as examples of the differences required in practical work.

Plate 49, Figure 1, is an example of a larger type of skin. This was a box calf skin measuring $13\frac{1}{2}$ feet. The arrangement in the centre is upon the system represented by Figure 1, Plate 47. The material good enough for whole vamps is first used up; keeping strictly to the system

of cutting locked-in vamps, the suitable material produced 5 pairs. The side of the tail being cut very much away, and the centre of the tail being very much flawed and cut about, the pair of locked-in vamps naturally going in the centre were omitted, and the whole system dropped down to fit into the sides of the butt. The centre being cut into whole vamps in this manner, the shanks on each side are cut into legs, leaving the flank and corner pieces as shewn. Wherever the material was good enough, toe-caps were arranged, as shewn, upon the right-hand side of the butt, the leg quarters were fitted close to the caps ; this being repeated upon the opposite side of the skin produced the first line. The middle of the skin would now consist of light, tight and tolerably fine stuff suitable for toe-caps. These should be arranged as closely as possible, working the legs in at the edges, in each case keeping the best part of the material in the part most likely to be seen. The coarser, stouter part of the skin is utilized into back straps, except that which is actually offal ; this produced 5 pairs complete, and an extra pair and a quarter of legs, and in addition could have been made to produce one or two more legs of a very low quality. This is equivalent to cutting at a shade less than 2½ feet per pair, the offal remaining was more than sufficient to cut the toe joiners.

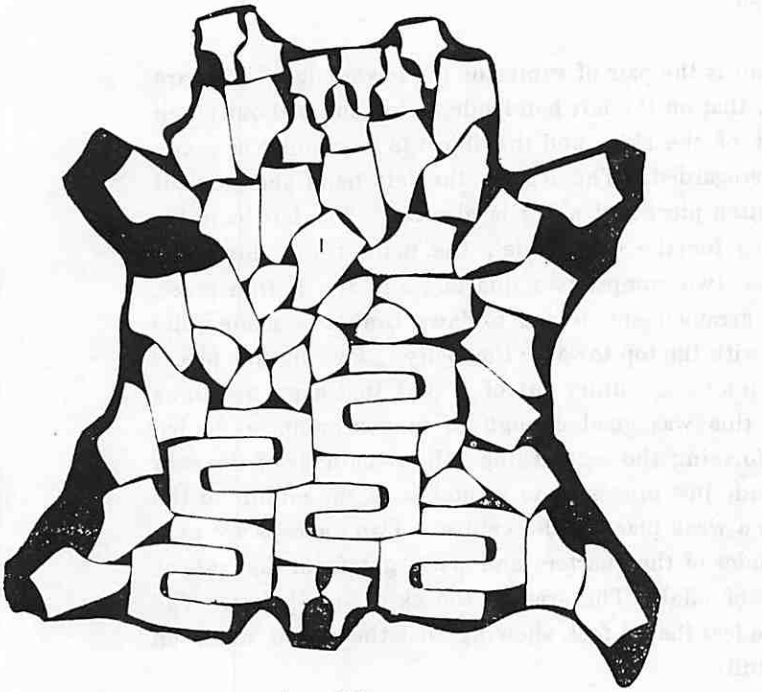
When considering the amount of surface area per pair required in cutting this class of work, full consideration must be given to the shape of the skin, its quality, and the peculiar shape of the patterns used. It is sometimes nearly as possible to cut closely from small skins as from large, but of course not quite so economical ; but large skins unless of the correct shape, quality and freedom from flaws, will not always produce an amount of cut stuff proportionate to their size. It appears that the skin from about twelve to fourteen feet produces nearly the maximum available surface in proportion to its area ; above that size the skins appear to become too coarse and to have a larger proportionate amount of offal.

Figure 2 represents the system of arranging Blucher whole cut vamps, suitable for large cutting surfaces ; this method is used in a similar way to those illustrated on Plate 47. It may be used with toes, or with toe and tongue towards the cutting edge. If the lower edge of the kip or side is of good quality, the toe may be cut towards the lower edge ; this leaving a good working line above it to fit the backs or another row of vamps. The system of arranging backs is illustrated at Figure 3. The lower edge is nearly a straight line. The system should always be commenced in this manner, and the back seams fitted against each other. This, in combination with the system of Figure 2, is the usual method of cutting Blucher work out of waxed hides or very large kips.

The lighter type of Bluchers or Derbys cut from a smaller class of kip, have to be arranged on a modified system, as shewn at Figure 4. In this case, the first vamp is cut in a similar way to that described in cutting skins. The vamp is arranged towards the backbone, with a back and toe-cap fitted into the wings. The next back is fitted towards the shank, with another back fitted just clear of the flank. Up the centre of the skin another vamp is arranged, so that the wings go round a bad place in the skin caused by the position of the hip bone, as shewn in the diagram. The next vamp is fitted close to this vamp, and two caps fitted close to that. This leaves the space for the other three backs to be fitted round it. The shank, flank and edges, are used up for fittings ; the light ends of the shoulders for shoe backs or other fittings. This kip had a very bad place in the centre, caused by the hip bone and two bad scratches ; one above the toe of the third vamp, and one just below the back, marked 9. The forepart ran off very thin.

Figure 5 represents the cutting of a badly flawed skin ; the whole of one side of the neck and one shank of the shoulder were marked with scratches. It is used as an illustration of what may have

Plate 49 (*continued*) and 50



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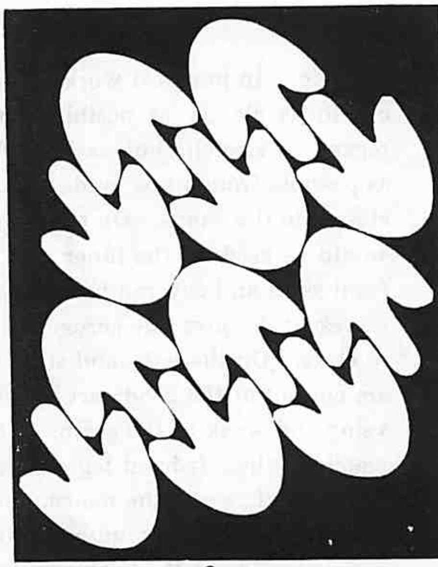

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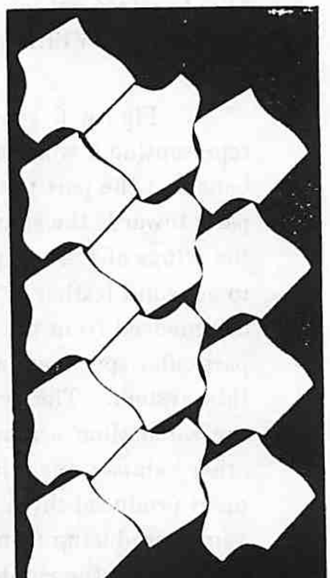

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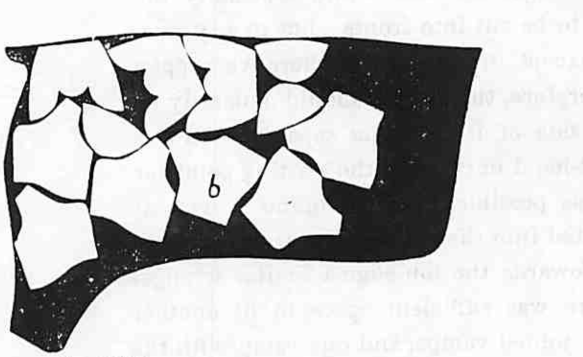

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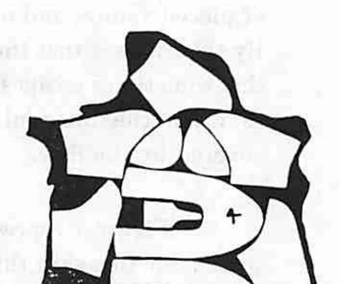


7—(49)

to be done in practical work. The first arrangement is the pair of vamps on the lower edge ; these are cut in as closely as posible ; one of the vamps, that on the left hand side, being cut without much regard to stretch, but as it is from a good part of the skin, and the object is to produce as much as possible from a low grade skin, the stretch is disregarded. The leg on the left hand shank is cut close into the vamp. On the right hand side, a button piece and a leg is also cut. The left hand leg would be used for the inner side, the right hand leg for the outer side ; the flank being down the front seam and covered by the button piece. These two vamps, two quarters and the button piece, represent the first line across the skin. The next arrangement, owing to flaws, cannot be made quite so close. On the left-hand side, a leg is arranged with the top towards the belly. Two button pieces are cut out of the good part of the leather, and then a back counter out of a part that happened to be veiny and weak in the grain. The stuff next to this was good enough to take a vamp, and a leg matching the left-hand leg comes naturally next, forming the second line ; the remainder of the skin was badly flawed ; the toe-cap on the right-hand side just misses some scratches in the middle of the skin ; another back counter having to be cut from a weak place in the centre. Two toe-caps are next got at the side of the back counter, and the remainder of the quarters and parts got from that side of the skin ; this leaves quite a considerable amount of offal. The area of the skin was 4½ feet. The actual surface cut in the different parts was a little less than 3 feet, shewing that the actual waste on this skin was a little more than one-third of the stuff.

Figure 6 represents the cutting of a crupp butt taken from a practical specimen, and representing a workshop arrangement. This leather varies in its substance and texture ; the back-bone and the part towards the tail are usually very weak ; the edges are also weak, especially the parts towards the shanks. These edges are sometimes too open to be cut into fronts ; but in any case, the wings of the vamps should be arranged towards the edges, except in those parts where we happen to get solid leather. The centre is usually very good, and therefore, the system should generally be commenced from the middle of the crupp, considering each side of it as being separate. In this particular specimen, a large brand mark in the centre of the left-hand butt forms the starting point for this system. The wings of two vamps were fitted as well as possible into the brand marks, at the same time arranging them until other vamps could be fitted into the edge ; this produced three other vamps : one with the toe on and two with the toe off. Towards the top edge a similar arrangement produced three joined vamps ; next to the backbone there was sufficient space to fit another vamp, producing from the left-hand side of the butt 4½ pairs of joined vamps, and one vamp with the toe on. On the right-hand side of the butt the first three vamps were arranged in the centre, grouping the others round to have the wings towards the edges as near as possible, and getting another pair of vamps towards the backbone—the arrangement is shewn on the illustration ; this produced five pairs of pieced vamps, and one vamp with the toe on to match the other produced on the opposite side. By this, we see that the brand mark on the left-hand side caused a loss of one vamp ; this is a matter that sometimes escapes proper attention. It is not possible to arrange so closely where there are flaws as when the material is fairly clear, and the loss of stuff is much greater than the mere surface covered by the flaw.

Figure 7 represents a systematic arrangement on a good class skin with the object of producing pairs ; for this skin this was an almost ideal arrangement, the parts being cut from those parts of the skin most suitable, and being produced to match. The whole vamps in the centre have the button pieces cut out of the centre of the wings ; this, although not a perfect arrangement, is far more economical than it appears by the Diagram. The legs cut out of the lower shanks are tight to toe,

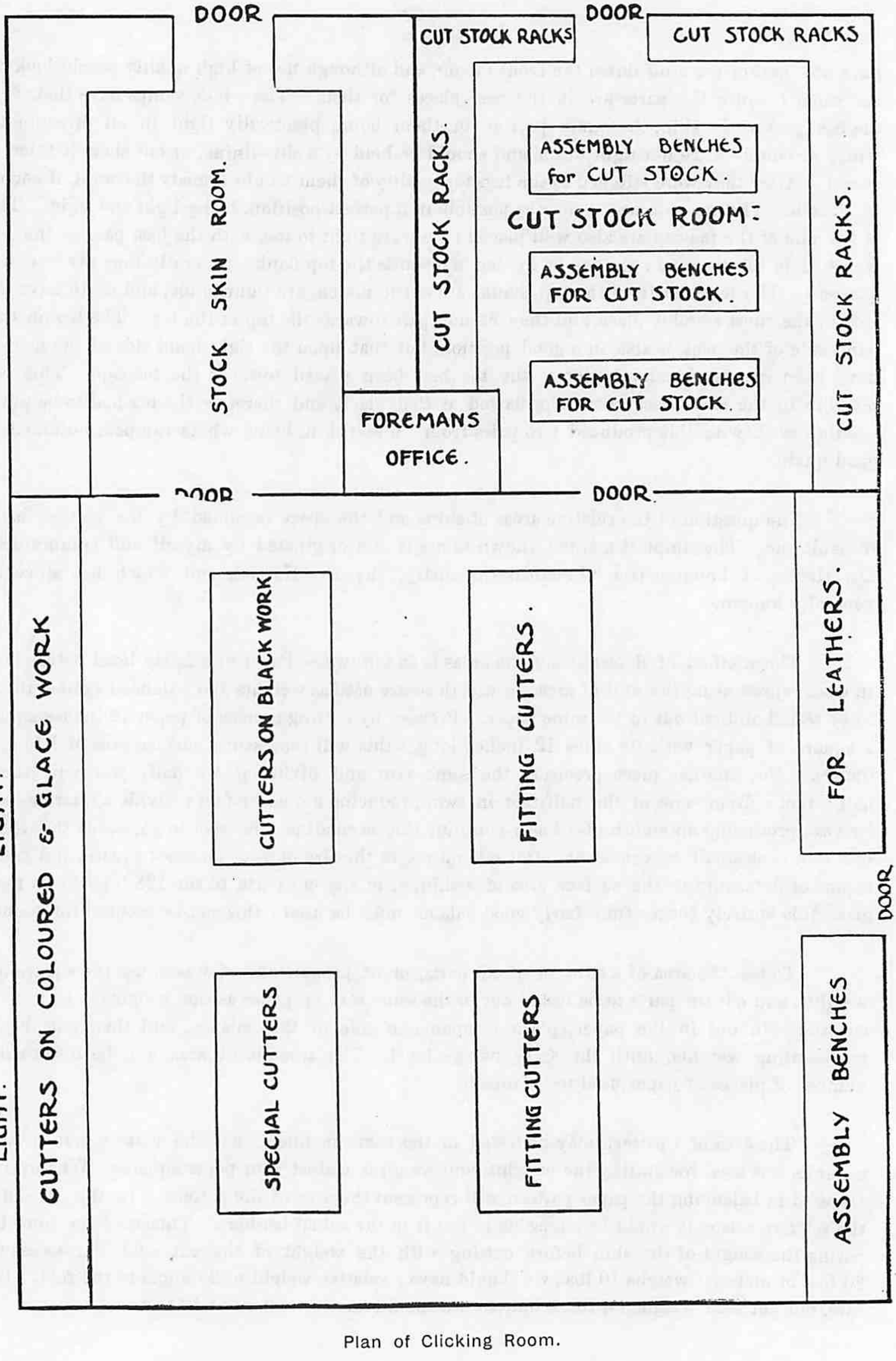
have the best of the stuff down the front facing, and although not of high quality would look well in the shoe, because the parts are in the best places for them. The whole vamps have their fronts in the best part of the skin, the vamp portion of them being practically tight in all directions. The wings or counters are not tight to toe and should be held by a side-lining, or cut short if fitted on the round. After they were stitched to the legs the quality of them would remedy the want of correctness of stretch. The toe-caps are as near as possible in a perfect position, being light and tight. The legs at the side of the toe-cap are also well placed ; they are tight to toe, with the best part in the position where it is mostly seen ; the top of the leg is towards the top flank ; generally they are two well-cut quarters. The legs cut from the top shanks are cut to match, are tight to toe, and again have the best part in the most suitable place, and the common part towards the top of the leg. The leg on the left-hand side of the neck is also in a good position, but that upon the right-hand side of the neck would have been diagramatically better if the toe had been placed towards the toe-cap. This was not possible in the skin, because it was flawed at that place, and therefore the leg had to be put in the position as shewn ; this produced two pairs from a 6 feet skin, being whole vamped, buttoned, and of good quality.

The question of the relative areas of skins and the space occupied by the pattern is a very difficult one. The simplest method known to me is one originated by myself and communicated to Dr. Harris, of Longton (see "Practical Chemistry," by Dr. Harris), and which has since become generally known.

The method of determining the areas is as follows :—Paper of a fairly level nature is cut out in sizes representing the unit of areas in use, these are used as weights and balanced against the surface to be tested and cut out in the same paper. Proceed by cutting a piece of paper 12 inches square, *i.e.*, a square of paper with its sides 12 inches long ; this will represent a surface area of 1 foot, or 144 inches. Cut another piece precisely the same size and divide it by half, you will then have half-a-foot ; divide one of the half-feet in two, producing a quarter-foot ; divide a quarter-foot piece by two, producing an eighth-of-a-foot ; continue this as small as you wish to go, about the 128th part of a foot is as small as you want. Cut several pieces the size of your one-foot square, and you have a means of determining the surface area of a skin, or of any cut parts, to the 128th part of a foot. To make this entirely successful a fairly good balance must be used ; this can be secured for about 25/-.

To test the area of a skin, or of cut parts, or of proportions of waste, use the square pieces as weights, and cut the parts to be tested out in the same sort of paper as the weights. If it is a skin, cut the skin out in the paper, place it upon one side of the balance, and then put the squares representing weights, until the scale swings level. The amount of area will be disclosed by the number of pieces of paper used to balance it.

The area of a pattern may be tested in the same manner ; cut the pattern out in the same paper as was used for cutting the weights, and weigh it against your paper squares. Whatever squares are used in balancing the paper pattern will represent the area of the pattern. In the case of testing the relative waste, it would be advisable to test it in the actual leathers. This may be done by comparing the weight of the skin before cutting with the weight of the cut stuff. If we assume that 80 feet of material weighs 10 lbs., we should have a relative weight of 2 ounces to the foot. If, therefore, our cut stuff weighed 8 lbs. 8 ounces, we should have a wastage of 12 feet.



Plan of Clicking Room.

These proportions of weights will not be constant for all material, but would vary with the substance as well as the quality, and would be more in proportion to the area and the substance than to the area and the weight. Naturally, there would be more waste in 10 lbs. of leather that measured 100 feet than in 10 lbs. of leather that measured 50 feet.

A comparison should be made between the cutting area of certain classes of boots and of different makes of leather. It frequently happens that particular kinds of skins produced by different makers have very different averages in their produce of cut work, and in all cases they vary very much from the area of a plain surface like a piece of paper and from one another. Different designs also vary in the actual surface covered on paper, as well as in the amount of material used in cutting skins. In a scale produced from actual specimens, in which the names of the makers have been omitted and numbers substituted, we find the following results :—Three pairs of whole cut vamped lace boots, with Boston back straps, occupied 7 feet surface marked out on paper. No. 1 specimen of box calf shewed 11 feet used for three pairs of these boots. Nos. 2 and 3, 10½ feet ; No. 4, 10¼ feet ; No. 5, 10 feet. This made a difference between the amount and surface actually used on paper and the amount of area occupied in cutting the skins of from 3 to 4 feet. The greatest difference between the makes of leather was one foot.

The following scale shews the method of comparing the leathers and the style of the work :—

	Paper.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Lace, whole vamp, Boston back	7	11	10½	10½	10¼	10
Derby	6¼	9¾	9½	9½	9¼	9
Lace, ¾ goloshed vamp ...	6¼	9	8¾	8½	8¼	8
Lace, Oxford shoes	5	7	6¾	6¾	6½	6¼

The arrangement of the clicking room will depend very much upon the light available ; a good arrangement is shewn in the plan. The leather stock room into which all material is entered from the main stock, or which may be used as a general stock room for upper material, should be at the side or near the clicking room. In some cases, it is equally convenient to have it on another floor, the material being sent up by a lift situated at about the same position as the foreman's office. The cut stock room may be situate at the side or on another floor, in the same manner as the leather stock room. Assuming the plan as shewn to be the one in use, the foreman would enter his leather to his cutters through the office, passing the material on to the bench in front of the office ; this would go to the cutters or to the benches kept for the purpose. Each cutter should have a bench about 5 feet long by 3 feet wide, it would be all the better if it were 6 feet long, allowing for a 3 feet board, and a space between each board of 3 feet. The bench should have a shelf underneath, and the cutter should have a rail, over which he could hang the skins. If the room had a top light, the cutters might be placed in almost any position. If the light was round the sides, the cutters would have to be arranged so as to face the light. In the plan shewn, it is assumed that the light is a side light. The outside cutters are placed next the side light. The fitting cutters on the second bench. Behind the fitting cutters a third table forms an assembly bench, where the cut work is arranged for the orders. An alternate method would be to use the third row table for the clickers' leather and orders, and to fit up the whole of the stuff in the cut stuff stock room.

Where a mixed trade is carried on, that is, where large quantities of certain lines are produced, and also small orders of nearly every conceivable kind of shoe, it is advisable to run a dual system,

i.e., keep the cutters engaged upon the stock work entirely distinct from those engaged upon the small orders, presuming the small orders are principally from the patterns that cannot be selected from stock. The stock cutters would be engaged in cutting up the skins to large quantities. It is a debatable point whether it is better to leave the roundings or to have them cut right up at once. Personally, I have a prejudice in favour of cutting the material right up, but a great many practical superintendents prefer to have the roundings left. Assuming the cutters to have cut the best part of the skins, and left the roundings for fittings or trimmings, these scraps should be entered back with the stuff cut and credited to the cutter ; they would be passed out to the fitting cutters to cut into stock. In this matter it is sometimes advisable to make a special method of determining the value of these fittings. Assuming that a cutter had out 1,000 feet of stuff, and returned 350 pairs of cut stock and a considerable quantity of scraps, it would be advisable to have the scraps cut up into trimmings, their value ascertained and credited to the cutter before determining the cost of the cut stock. Quite commonly there is a mistake made at this part. The value of the scraps is placed at some imaginary price ; this may be higher or lower than the true value, but it most probably leads to inaccuracy in costing.

The fitting cutters for large stock orders are preferably kept on one kind of work ; but some opportunity should be given to these fitting cutters to become acquainted with their business ; and therefore when there is a mixed trade done in addition to the stock trade, the stock fitting cutters should be promoted to assistance in the small order cutting section, and by this means gradually taught to become cutters of outside stock.

The special order cutters should be arranged in a different way ; generally, one first-class cutter engaged on cutting outsides only, would occupy about half the time of a fitting cutter. These small order cutters could be arranged as one fitting cutter to two clickers. These clickers should be encouraged to allow the fitting cutter to assist them in cutting outsides whenever he was not otherwise engaged ; this would encourage him to be speedy in his work, and give him the opportunity of acquiring a knowlegde of his business. The fitting cutter should be responsible for the whole of the fittings, and a separate stock of linings and other material should be kept for the bespoke and small order department. The work for this department should be tied up ready for the closing room, and the cutter should be held responsible for the whole of the small order.

In some businesses, specials or measure work are given to the stock cutters to work in with the orders for stock ; this is scarcely fair on the cutter, and it is very doubtful whether there is any real economy in it. The confusion caused by the distribution of a large number of single pairs between fitting cutters and outside cutters, and the supervision required in the assembly, more than counterbalance the supposed advantage of getting the measures cut in with the stock work. Where anything like a cutting trade is done, it is better to keep a special bespoke or measure cutter entirely on that class of work.

Each cutter should have patterns in sufficient variety to be adapted to the class of leather. Where large surfaces of uniform quality are being cut, one size and class of pattern may be sufficient : but where material varies a great deal in its substance and quality, there should be a variety of patterns available in proportion to the variation in the material. For instance, if large surfaces of waxed leather are being cut, and it is considered desirable to leave the roundings, then one or two sizes in vamps would be sufficient to work up the material, or one or two sizes of vamps and legs would be

sufficient to work up skins of large surfaces; but with smaller skins, such as glacé skins, of 6 feet or thereabouts, it is an advantage to have the use of low shoe backs and vamps, to work in with buttoned or lace boots.

There is some prejudice against cutting mixed classes of work out of one skin, owing to the difficulty of determining the respective value of the parts, and to the fact that cutters are more likely to force the produce of the parts that pay them best, than to cut the work actually required. This becomes a practical difficulty when a system is adopted of allowing clickers to cut to order and to work in other patterns to work the stuff up. It sometimes happens that the leather is cut to the stocking sheet and not to the order.

It may reasonably be expected that cutting tickets for work sufficient for two days should always be in hand in every department. This permits of the material being sorted for quality and quantity, and allows the foreman to arrange the work to suit the capabilities of the men under him. Some cutters are very good workmen on high-class leathers; they appear to have a special faculty for cutting small difficult skins, but do not show well on large level leathers beside others who are quicker cutters, but who have not the experience or the faculty for cutting small skins. Others are very good upon coloured work, but do not show well on anything else. It is advisable to utilize these men for each of these classes of work.

Where large quantities are cut and passed into stock to be afterwards sorted, care should be taken that the leather given out to the various cutters is done so in such a manner that all sizes are produced in each quality. For instance, it would be a bad plan to give most of the best leathers to the cutters who were working on the medium sizes, and by that means make it very difficult to get a complete run of sizes of one quality.

The work should be put together ready for the closers; it should be carefully skived, pricked to shew where the parts are to come together, stamped, the different parts matched or fellowed up, and passed into the closing room in a condition to be worked upon at once. These operations are best done in a room separate from the cutting room, which is generally called the cut upper stock room.

Closely connected with the clicking room should be a well arranged skin room, which will be used as a stock material room for the clicking shop. The leather should be checked and arranged upon shelves free from damp and too much light; each parcel should have a ticket attached to it, with the folio number, the date it was passed into the stock room, and with spaces for the details as to the amount of material taken from the bundle. The amount taken from each one of these parcels should be entered in a day book, stating the amount given out, quantity cut and quantity returned; this will be posted in the stock book in the office.

This upper leather stock room should be fitted with broad shelves about 4 feet wide by 6 feet long. It is preferable that they should have some screen to keep off the light. No stock room should be subjected to the direct rays of the sun. The windows should have a blind and, preferably, each of the shelves should have a separate canvas hanging in front of it.

The cut stock room should be fitted with racks and pigeon-holes, of a size to take the usual cut stock. These pigeon-holes should be divided into groups representing qualities, and marked plainly in some prominent place, as A B C D. The pigeon-holes may be arranged to take sizes counting

from the bottom, at about 2 feet from the floor, and including a range of six sizes. Assuming this group to be quality A, six sizes of this quality in all the usual stock lines could be included in this group. Pigeon-holes 9 inches wide would be an ample width. Therefore, sets of pigeon-holes of a 9 feet run would take twelve different styles in one quality. The same method applies to the inside fittings, but some linen linings are better stocked in drawers with some of the smaller fittings. It is sometimes an advantage to sort into qualities in the stock room, but on principle it would be better to sort in the clicking room, enter the sorted stuff through the office into the cut stock room, and credit the stock with anything taken out for orders put together on the assembly bench. The cut stuff should be sorted out for quality and substance. Generally speaking, four qualities and four substances are about sufficient. In the case of coloured leathers, they would also be sorted for shade. Four shades of one colour will be sufficient. In putting the coloured leathers together, it is advisable to put the darkest part at the back of the shoes. The toe-caps, however, may be a little darker than the vamps, because the strain, when lasted over the toe, naturally opens the skin and causes the toe-cap to take a lighter shade.

Waxed leathers must be carefully sorted for substance, and the weights of 12 pairs per size recorded in the book ; this would give a basis upon which to sort. They should also be sorted out into three qualities at least, as regards fineness of face. This would produce seven sortings from one cutting.

In estimating the value of cut fittings the price would be decided per pair, not by the pound. It is no advantage to have stout inside fittings ; they should be of a substance suitable for the class of work, and may have to be split down. Outsides sorted into qualities and substances may be priced at per pound ; the difference in the estimate for each sort being decided by what they could be produced at from some other leather. By this it would provide for their being cut in any quantities.

A convenient method of checking the material of one particular line is shewn on the cutter's sheet. In this case the debit is simply entered in numbers of feet in the folio number without value. The credit is the number of pairs of the special order or parts produced from it. It is a matter for the office to fill in the value of the number of feet of material, folio number 1538. When this is completed the cutter's sheet is balanced up as specimen shewn. This is a method for checking upper stock that is entered into stock in parcels, exhausted, and a balance struck.

The method of determining the value or cost of cut stock will probably be best understood by using examples that have no reference to particular material. We will, therefore, use numbers instead of names when referring to materials or cut stuff. It must be evident that if material is cut up into one quality, and we divide the value of the material by the quantity produced from it, we shall ascertain the cost—See example 1.

Where there is more than one quality, the value of the product becomes uncertain, and must be determined by comparison with the value of one or more qualities with some established standard. If we suppose that in cutting for stock, that we have cut 200 pairs of a particular number, and that we have cut in with them 32 pairs of another quality, the value of the 32 pairs deducted from the total cost of material, would give the total cost of the 200 pairs produced. The item of 32 pairs is a most important factor, and its value must be determined by what it would cost, if cut into quantities from some other material. This principle would be applied to an indefinite number of qualities. We will assume that a low grade skin produced Boot number 566, at 1/6. If 32 pairs of 566 were cut in with

200 pairs of 227, by subtracting the cost of 32 pairs at 1/6 from the value of the material used for the 232 pairs cut, would give the value of 200 pairs of 227—See example 2.

SPECIMEN CUTTING SHEET. (1).

Cutting Sheet No.	Cutter's No.	Out.		In.			
		Date.	Time.	Date.	Time.		
357	29	30/8	9.15	1/8	9.15		
		Time Cutting,	at	£	s.	d.	
		2 days.	5/6	0	11	0	

To Folio No.		Quantity.	at	£	s.	d.
1538	...	480 feet	$6\frac{1}{2}$d.	13	0	0

					£	s.	d.
By Returns	...	Folio 273	...	7 lbs. at 1/-	0	7	0
169 pairs	...	No. 566	...	at 1/6	12	13	6
					£13	0	6

SPECIMEN CUTTING SHEET. (2).

Cutting Sheet No.	Cutter's No.	Out.		In.			
		Date.	Time.	Date.	Time.		
358	25	31/8	8.0	3/9	8.0		
		Time Cutting,	at	£	s.	d.	
		3 days.	5/6	0	16	6	

To Folio No.		Quantity.	at		£	s.	d.
1627	...	643 feet	$8\frac{1}{2}$d.	...	22	15	$5\frac{1}{2}$
		By Produce	...	...	22	15	8
		Profit	...	...	0	0	$2\frac{1}{2}$

						£	s.	d.
By 26 pairs	...	No. 566	...	at 1/6	...	1	19	0
200 pairs	...	No. 230	...	at 2/1	...	20	16	8
						£22	15	8

If we carry this principle a little further and assume three qualities, and that 566 was worth 1/6, and 230, 2/1, and that in this particular example we produce from the material stated 45 pairs of 566, and 38 pairs of 230, and 365 pairs of 132, we should have a similar problem, but extended to three qualities. We should first add the value of the 45 pairs of 566 at 1/6, to the 38 pairs of 230 at 2/1. The total of these two items would be subtracted from the value of the material; the remainder divided by 365 would give the cost per pair of No. 132, as specimen.

SPECIMEN CUTTING SHEET.

Cutting Sheet No.	Cutter's No.	Out.		In.			
		Date.	Time.	Date.		Time.	
359	23						
		Time Cutting		at	£	s.	d.

					£	s.	d.
To Folio No.		Quantity.		at	£	s.	d.
1540	...	1216 feet	...	$10\frac{3}{4}$d. ...	54	9	4
		By Produce		... ...	54	9	7
		Profit		... ...	0	0	3

					£	s.	d.
By 45 pairs	566	... ...	at 1/6	=	3	7	6
38 pairs	230	... ...	at 2/1	=	3	19	2
£ s. d.							
54 9 4							
7 6 8					7	6	8
£47 2 8							
365 pairs	132	... ...	at 2/7	=	47	2	11
					£54	9	7

Upper stock should be entered in a purchase book with a special folio number that should be attached to every portion of the parcel cut up. The specimen form of entry given below may be adopted, or any other system that includes a debit and credit account for the material. In this case the folio number is substituted for the name of the firm from whom it is purchased, its trade name and cost. It is no part of the business of the superintendent of the clicking department to ascertain the cost of cut stuff; this is office work and should be carried out in that department. Therefore, the folio number, a brief description of the material and the number of feet, is all that need be supplied to the upper stock room for the cutting department. Where, however, the superintendent is a man of great experience, and has the confidence of the proprietors, he may be supplied with the cost and become actively employed in the selection of materials for particular numbers. Assuming that folio 169 represented 2,256 feet of glacè goats, at $8\frac{1}{2}$d., as specimen given, this would be the debit to the upper stock department. The credit would be the amount of leather used up for the different orders

cut from it. These might be entered as shewn on the example; or a modification made to suit the requirements of the individual business. The items in parallel columns, beneath the entry of the principal amount represent the debit and credit account to the order, boot number and cutter. The quantity of material entered out to the cutter is the debit to him, it is also the credit to the bulk of the material entered into stock. The value of the cut stuff would be the credit to the cutter, and the profit and loss column the result of the cutting of that particular order. The cutting of this particular line will serve to illustrate the method upon which cut stuff may be tested and the cutter's efficiency ascertained. It will be seen upon analysis, that boot number 23 had been cut five times out of this material. Upon three occasions it was cut by the stock cutter 27. Upon each of these cuttings he made a loss; upon the other two occasions it was cut by stock cutter 32 and 39, each of these made a profit. It may therefore be assumed that stock cutter 27 had better either leave off cutting that kind of stock, or take his abilities elsewhere.

We find on further analysis that boot number 35, 138 and 169, all shew a profit. It may therefore be safely assumed that stock cutter 27 has mistaken his vocation, or is unfortunate. The total result of the profit and loss account is that there is a clear profit on the cutting of the material. The total quantity used in the various orders should equal the quantity put into stock; supposing the material to be exhausted, this quantity should be entered under the quantity debited to the folio number, and should equal it. A comparison between the amounts representing the profit or loss would give the result of the cutting.

SPECIMEN FOLIO.

Folio No.		Quantity.		Description.		at	£	s.	d.
169	...	2256 feet	...	Glacé Goat X 5 P.	...	8½d.	79	18	0
Amount used	...	2256							

Date.	Quantity out.	Cutting Sheet.	Cutter.	Boot.	Profit.			Loss.		
1905					£	s.	d.	£	s.	d.
6/4	250 feet	364	32	35	—	7	4	—	—	—
7/4	200	358	27	23	—	—	—	—	9	2
7/4	187	366	39	23	—	3	7	—	—	—
8/4	263	367	33	138	—	8	2	—	—	—
9/4	389	356	27	23	—	—	—	—	10	7
9/4	275	352	26	169	—	6	3	—	—	—
10/4	151	371	27	23	—	—	—	—	5	5
11/4	98	369	45	35	—	2	8	—	—	—
11/4	277	368	27	138	—	—	—	—	3	1
11/4	166	373	32	23	—	2	9	—	—	—
	2256 feet				1	10	9	1	8	3
					1	8	3			
				Profit.	0	2	6			

In some cases, material is being constantly entered into stock of precisely the same value, character and quality, in which case it would be inconvenient to give a separate folio number for every parcel entered in. For instance, offal or roundings from other material, should be as carefully checked as anything else, but it would not be convenient to enter them in separate parcels with distinct folio numbers. In this case, a folio number as 298 is given at an estimated value per lb. If we assume that these are constantly being entered in and used up, and that we wish to check the debit and credit account, a convenient method would be an application of the Home Office method of keeping accounts, in which the debit and credit accounts are kept on the left and right hand sides of the date column. In the debit account we have the amount, the value, name of vendor or cutting sheet number. On the credit side we have the boot number, cutting sheet number, cutter, quantity and value, and the usual profit and loss columns. The amount of material that should be in stock could be determined at any time by simply totaling up the amount on the debit side and the credit side, and comparing their numbers. The difference in their numbers would represent the amount in stock; it must be evident that there must either be something in stock or the amounts must be equal.

Folio.	Description.	at
943		

DEBIT.			Date.	CREDIT.							
Quantity.	Vendor.	Cutting Sheet.		Quantity.	Cutting Sheet.	Cutter.	Profit.			Loss.	

The sub-division of labour in the clicking room makes it indispensable that the actual cost of cutting each part should be determined. This should be done something upon the system as shewn here, setting out the whole of the parts in different classes, styles of work, and setting off against each

of the items the estimate for the cost of cutting. These being totalled up, would give the cutting price for the particular syle of shoe. In addition to the amount charged to each man, a percentage should be added for the cost of supervision, rent, light, and wear and tear. This extra charge would be determined by dividing the total amount into the number of pairs produced in the room. For instance, assuming that the room produced 3,000 pairs per week; that the foreman received £3 per week; that there was a charge of £1 per week for rent; 10/- for light and 10/- for sundries; the amount to be added to the charge per pair equals 1/30th of a penny, which, if a profit was expected on the room, should be set down as ½d. per pair. An example of these cutting costs is given below, by which it will be seen that the actual cost of cutting varies between 1/5 and 1/9½ per dozen; but with the added expenses, comes out at 1/11 to 2/4½ per dozen; many manufacturers would consider this as 2d. to 2½d. per pair. These prices must not be accepted as a standard, they are much too high for some classes of work, and some manufacturers would like to cut as cheaply.

METHOD OF SETTING OUT DETAILED COST OF CUTTING OUTSIDES.

Per dozen pairs.

	Lace.	*Button.*	*Open Tab.*	*Shoes.*
	d.	*d.*	*d.*	*d.*
Vamps	3½	3½	4	3½
Backs	4	4	4	6
Caps	2½	2½	2½	2½
Legs	5	—	5	—
Button Pieces	—	1	—	—
	1 3	1 4	1 3½	1 0

LININGS AND FITTINGS.

Per dozen pairs.

	Lace.	*Button.*	*Open Tab.*	*Shoes.*
	d.	*d.*	*d.*	*d.*
Linings	1	1	1	—
Facings	1½	—	1½	—
Top Bands	½	½	½	—
Back Stays	½	½	½	½
Tongues	1	—	2	½
Butt. Linings	—	1	—	—
Backers	¼	¼	¼	¼
Toe Joiners	¼	¼	¼	¼
Vamp Linings	—	—	—	¼
Back "	—	—	—	3¼
Cost of Fitting	0 5	0 3½	0 6	0 5
" " Outsides	1 3	1 4	1 3½	1 0
	1 8	1 7½	1 9½	1 5

The method by which leather is tested as to its quantity has an important effect on its quality. Naturally, the leather manufacturer endeavours to produce a material that contains the features that demand the greatest amount of payment. Generally, the method of judging material may be grouped into three systems : purchases by weight, by measurement, and by hand.

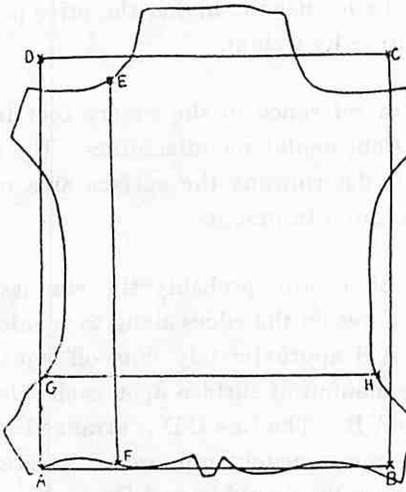
Leather produced for purchase by weight, has naturally the greatest amount of substance left in it. The natural substance of the skin is very little interfered with during the process of manufacture, the estimate of its value being based upon the quantity as regards weight, every effort is made to produce a good-substanced material, and as the surface finish costs as much for light leathers as for stout, the lighter the leather—other things being equal—the higher it is in price per lb. At the same time, there is naturally a desire to add during the process of manufacture, materials that have a tendency to increase the weight. In leathers that are stuffed with grease, any added grease would add to the value of the leather far in excess of the cost of material or the labour used in applying it.

In testing leather for extra stuffing with grease, a very simple method may be adopted. Fold the leather with the grain side out, then make another fold across the bent edge of the first fold ; this will bring some of the grease on to the surface. If the leather is heavily stuffed, it will shew in the form of a thin oil. If not heavily stuffed it will simply shew a little darker. In any case, upon the leather being smoothed again, the fibres of the leather should absorb the grease thrown out. If any loose grease remains upon the surface, it may be taken that the leather has an undue amount of stuffing.

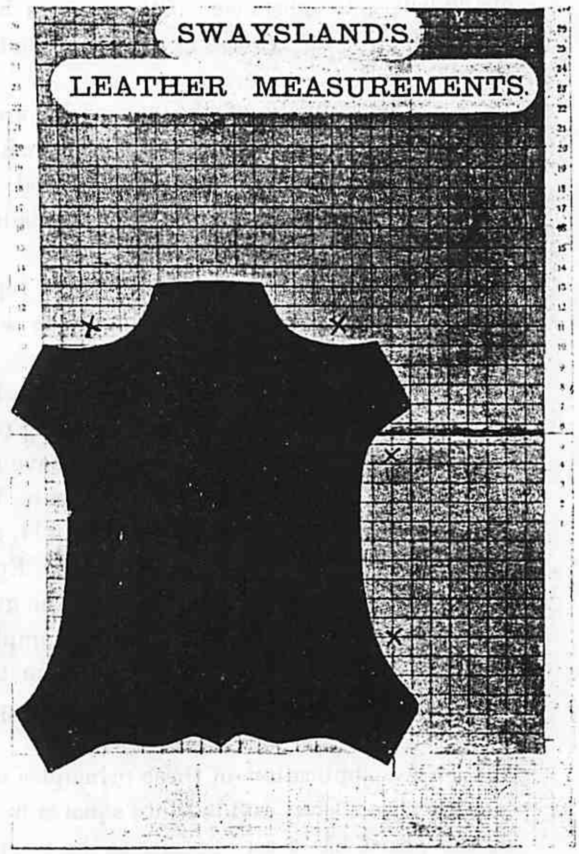
These remarks apply to ordinary curriers' grease, and in only a modified form, where the stuffing consists largely of paraffin waxes. The fact that there is little inducement to reduce the substance in material when it is sold by weight, has a very beneficial effect. There is very little tendency towards shaving down the natural substance of the pelt to suit a passing demand by the market.

It may generally be taken that leathers bought by weight are nearer their natural substance than when bought by measurement, but that they are usually weighted in some way, either in the tanning or in the currying, and that the stouter parts of the offal are not trimmed away so much as they might be. Skins curried in England are sold by the lb. Those curried upon the Continent by the kilo. A kilo is approximately 2 lbs. 3 ozs. As mentioned before, it is a debatable point what constitutes a calf skin, it may be taken that any skin up to 10 kilos per dozen may fairly be considered a calf skin ; but skins are sold as calf skins up to 40 kilos, and they are sometimes very fine, first rate specimens of leather used for the highest class army trade.

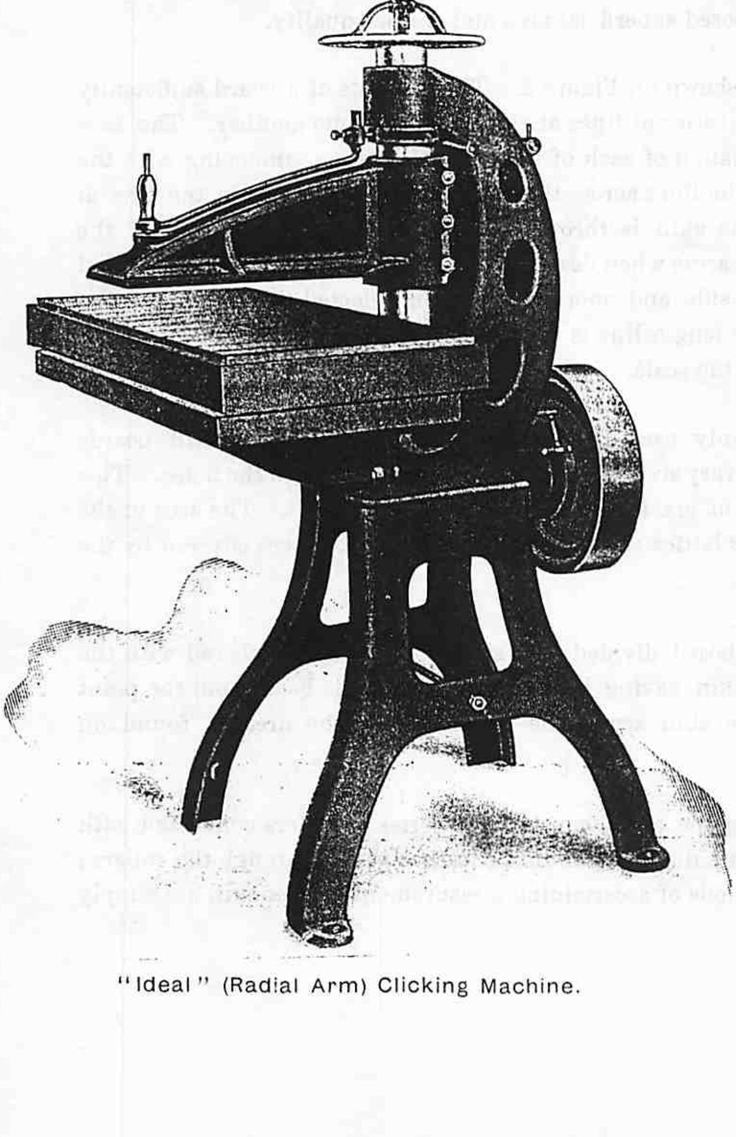
Leather bought by measure is subject to different conditions altogether ; the standard of value is the surface area, and consequently every effort is made to increase that area, or at any rate not to decrease it. In waxed leathers we have practically untrimmed pelts stuffed out with parafin wax to hold and disguise the offal. Other leathers have a great deal of offal retained in them, which is of very little value to the boot manufacturer, and which would be more practically utilized if it was trimmed off in the pelt, and finished in a different manner to the main body of the skin that is to be used for outside ; these roundings might be dressed for fittings, and would be of far more value than they are as fitting leather cut from the material used for outsides. There is also a tendency to split the leathers, producing several substances and getting, so to speak, several payments for the one skin ; consequently, in leathers bought by measurement, great care must be taken in examining the conditions



Estimating Area.



Measuring Board.



"Ideal" (Radial Arm) Clicking Machine.

"Ideal" (Radial Arm) Clicking Machine,

by

The BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

of the pelt as to substance. Other things being equal, the stouter the leather the higher the price per foot; which is the reverse to the principle laid down in buying leather by weight.

The estimate of the superficial area of leather is made in reference to the square foot in England and America; and for the English speaking markets by Continental manufacturers. Upon the Continent the square decimetre is used. The method of actually determining the surface area of a skin is very complicated in theory, but admits of a very simple solution in practice.

Taking Figure 1, Plate 51, as representing the outline of a skin, probably the simplest mechanical method is by drawing lines which fairly divide the curves on the edges along each side, and then multiplying one by the other. For instance, the line A B approximately cuts off equal amounts of the lower curve of the skin, leaving about the same amount of surface upon each side. The line B C cuts off equal amounts along the side, as does the line A B. The line C D is arranged in the same manner across the top. We have now a rectangle which approximately represents the area of the skin. If we assume A B to measure 30 inches, and B C 36 inches, we should have A B multiplied by B C, equals 1,080; this, divided by 144, gives us $7\frac{1}{2}$ feet, that being the area of the skin. Some Continental manufacturers, and a few English producers of upper leather, estimate their square measurement by taking the line from the gullet to the butt, and another across the teats, as E F, G H; this measurement is taken on the assumption that it includes the leather which is of any value. It produces an estimated measurement something less than any other method, and partly explains the difference in results attained by skins of supposed superficial area and similar quality.

An application of these principles is shewn on Figure 2. This consists of a board sufficiently large to take a skin, divided into squares by a series of lines at right angles to one another. The base of the board has a set of scales at the termination of each of the vertical lines, commencing with the line at 12 inches from the left-hand side. The lines across the board are numbered from the line at 12 inches from the base, as 1, 2, 3, 4, etc. The skin is thrown upon the board upon precisely the same principle as explained in determining the areas when dealing with Figure 1. A line being selected which represents the average curve at the side, and another line being selected that represents the average length of the skin, the number of the length line is found upon the scale at the bottom of the side line. The area of the skin is printed on the scale.

A simple piece of apparatus commonly used in America is made by jointing stiff boards forming a square. These boards are bored at every six inches, and wires drawn through the holes. This produces a lattice work consisting of squares of six inches in side or quarter feet. The area of the skin is determined by being thrown upon this lattice work, and the number of spaces covered by the skin give the area.

Another very similar method, is a board divided in a similar way, and numbered with the area from the base and left-hand side. The skin having been thrown upon this board, and the point decided at the gullet that fairly divides the skin across the top and side, the area is found on the corner of the lattice markings.

A mechanical method of ascertaining the areas, consists of a series of rollers connected with clock-work arrangements, which records upon a dial the amount of leather passed through the rollers; this is probably one of the most accurate methods of ascertaining measurements. The skin has simply

to pass through the machine and the area read off from the face of the dial. The Moenus Machine Co., of Frankfort-on-Main, are the proprietors of this machine.

Purchase by hand is practically purchase by judgment, and can only be carried on by persons having great experience. Seeing that the sample leather has to pass an examination by a practical man, who has a definite idea of his exact requirements, there is less tendency for the leather to be artificially prepared than by the other methods; but this system is fast dying out, owing to the uncertainty of the standard and the decrease in the number of persons possessed of the requisite judgment.

However, in the purchase of material by weight or measurement, a certain amount of judgment is still required, as by the system of purchase by hand. At the same time, many firms are now selling by repute, that is to say, they have largely standardized their production, and a greater certainty of cutting values can be secured to-day than at any other period.

CHAPTER VII.

Upper Fitting and Machining.

THE processes included in upper fitting or closing, are the first of the constructive processes of Shoe Manufacture. Fitting, is the term used for the skiving and sticking together of the parts of the top, before being stitched.

There are several distinct methods of fitting which the student should be acquainted with, although some of them are, for the time being, not generally in use. Paste fitting is the term used for the sticking together of the various parts by the use of paste or some other adhesive. This fitting together may be done upon a flat surface, such as a board or marble slab, and the whole of the parts may be stitched on a machine with a flat bed ; this is termed "flat fitting," and "closing on the flat."

Another method of fitting is called "fitting on the round." By this method, the various parts are stuck together on a block, which is very similar in its shape to a last, but has a leg attached to it. In many factories of fair class men's work, it is usual to use a combination method, consisting of partly fitting on the flat and partly on the round. Where the work is stuck together on a block, the vamps are usually stitched on a cylinder arm machine, by this means keeping the shape of the upper during the process of closing ; this is called "fitting on the block" and "closing on the round." A very high class of closing consists of fitting the parts on the actual lasts to be used in making and stitching on the arm machine, as by the round process. This is "fitting on the last," and is the ideal method of closing a top to fit a last ; it is, however, far too expensive for ordinary manufactured goods. During the last few years, a method has come into use called "The holding together system" ; by this method, most of the parts are simply held together while the machinist stitches them, thus doing away with the expense of the fitter and the disadvantages of the use of adhesives. Each of these methods have their advantages.

The disadvantages of paste fitting is generally admitted, but no other system quite produces the same set and finish. The latest development is a combination of the "holding on" method, with some fitting by machine and some fitting on the round, in men's vamped work. It has been found that although the cost of a fitter is saved by holding together, the amount saved is often exceeded by the extra cost in the stitching of blucher-fronted golosh boots or ordinary laced boots with goloshes that have back-straps attached to them.

The introduction of improved folding and beading machines has also modified the methods of closing, and made it possible to produce a finish to the edge, by means of power folders and beaders ; that is far better than the "bagged" system, or "held together" system.

The different classes of closing are intimately connected with the style of edge desired in the finished upper ; the simplest edge is left quite raw, as cut, or it may be trimmed off by machine at

some set distance from the line of stitching. This raw edge may also be ironed up with a special iron called a "set," in which case it is termed a "set up" edge. A certain amount may be left over the required edge of the material and bent down, forming a round edge, or bead ; this is termed a "folded" or "beaded" edge ; it is done by hand or by machines, of which there are several in the market. The raw edge may also have a strip inserted in it ; the strip having a finished edge, sometimes highly glazed, and being arranged to just shew round the edge of the raw material. This is called an "inserted" or "loose" bead.

Another method of finishing the edge is to put the part forming the lining to the face of the outside, stitch the edges together, and then turn them over ; this produces a rounded surface on both lining and outside, and is called a "bagged" or "turned" edge. The turning or bagging may be arranged to come at the edge of the upper, or some distance inside or outside. If the seam comes below the edge upon the outer side, the lining forms a bead ; if the outside is brought down inside the lining for some distance, the outside forms a narrow top-band, and makes its own bead (see Plate 26).

Plate 52 illustrates some of these different edges. Figure 1 is the raw edge ; Figure 2 the loose bead ; Figure 3 the folded edge ; and Figure 4 the turned or bagged edge. Each of these edges require special skiving or bevelling off by hand or machine. The raw edge should be skived according to the material, the part of the upper it is to go into, and the particular finish of the edge required. Materials of a solid nature, that are also long in the fibre, may be skived down light ; these include waxed leathers that are finished on the flesh. If the edge is to come to the outside, it should be left on, with sufficient substance to carry the stitch. It is evident that if it is skived down very thin, the stitches coming near the edge and upon the thinnest part are likely to break away. Upon the inner side it should be skived down to a very thin edge, so as to leave no sharp surface upon the inner side of the boot ; the two skives together should blend, forming one substance, as Figure 5. If the material is short in the fibre, as splits, it should be skived with a stunt or thick edge, upon the outside, so that there should be sufficient material upon the outer edge to carry the stitch. It would otherwise be likely to break away—See Figure 6. Edges of good soft material should be skived according to their substance. Leathers, such as glacès, are preferably skived quite close to the edge. Beaded edges with a loose bead, should be skived quite close to the edge to just set down into the bead, as Figure 7. Folded edges should be skived so that the position of the fold comes exactly in the centre of the skive, by which means, when the material is turned over, a uniform substance is produced—See Figure 8. The bagged edge is only applicable to light material, or where one of the materials is light. The skiving will depend upon circumstances. If both of them are very light, they will not require skiving, except at the extreme edge. If one is much stouter than the other, and a bead is required to be made by the light one above the edge of the stout, then the stout one should be skived to form a neat seam—See Figures 9, 10, 11.

All these skives can now be made by skiving machines, of which there are several distinct styles. For waxed leathers, a fixed knife against which the material is pushed as the carver gives very good results ; but this kind of machine is not adapted for soft materials, or for very fine skiving. Another type of machine consists of a rotating disc, which is automatically sharpened by an attachment, and which is capable of skiving light materials ; this machine —"The Amazeen"—is in common use for light classes of work. Another type of machine consists of a band knife, which, travelling along the surface to be skived, cuts in a very similar way to a hand knife ; this will skive

To face Page 104.

Plate 52.

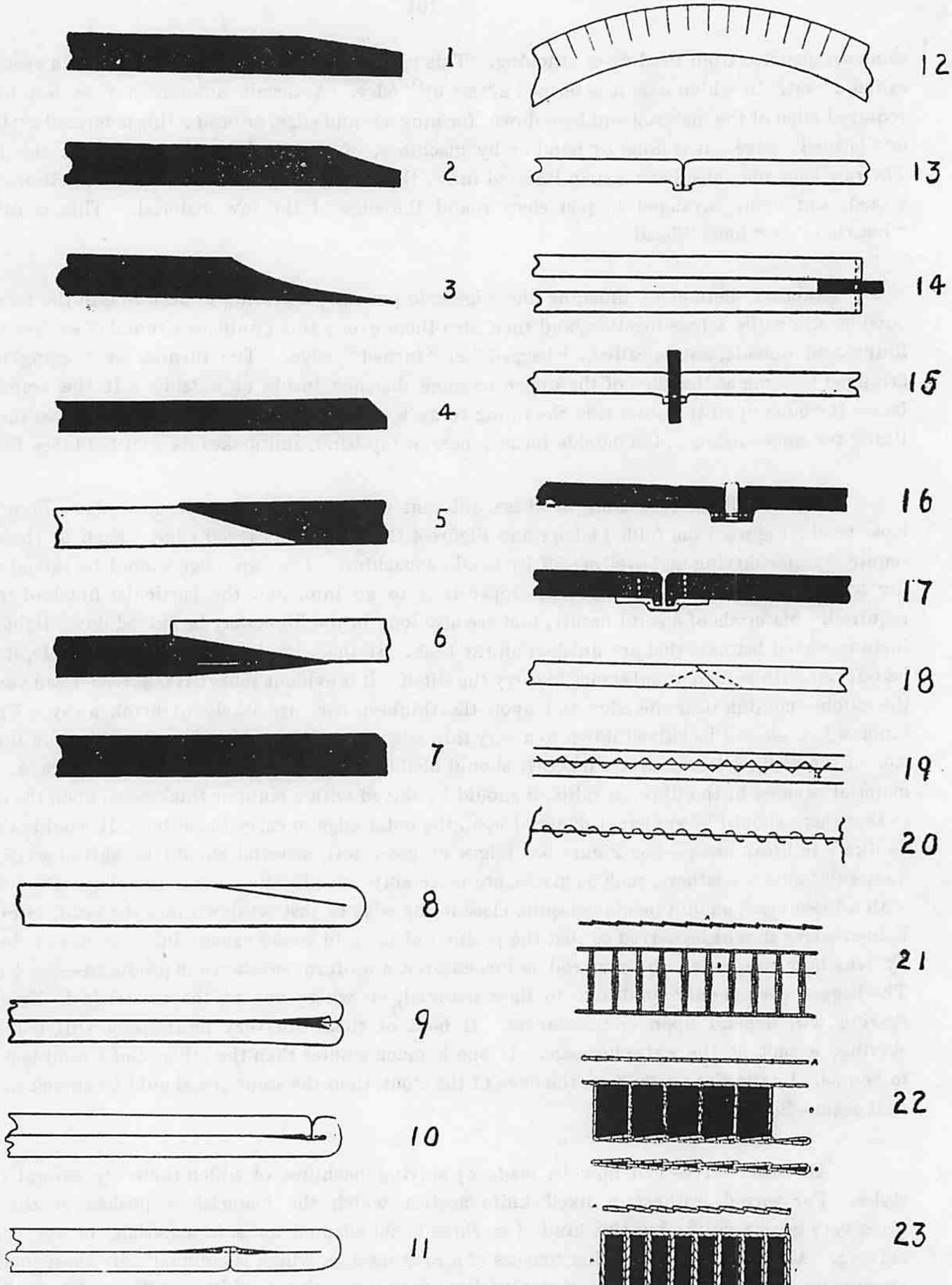
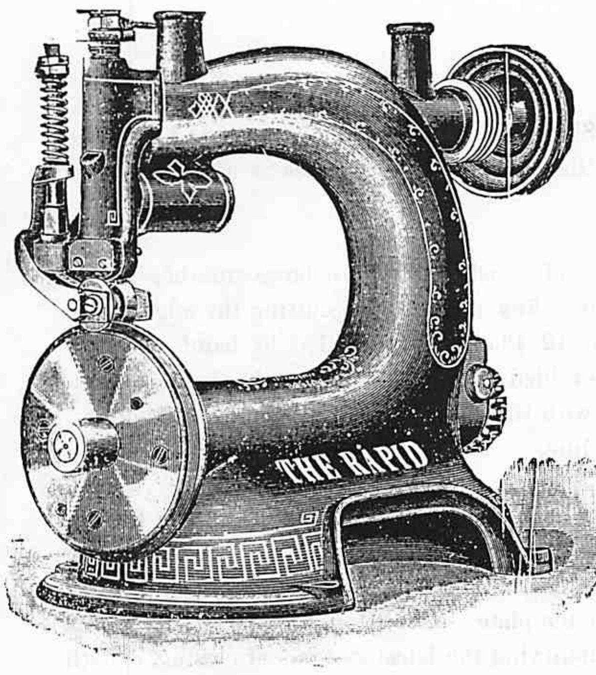
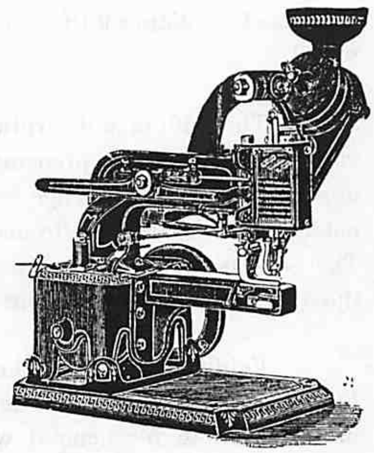


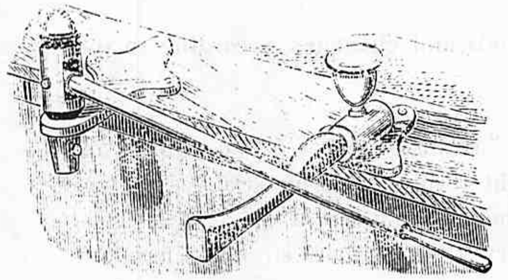
Plate 52a.



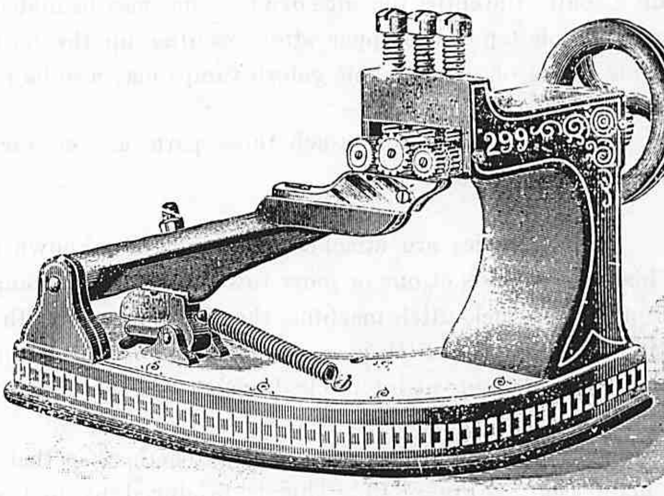
Rapid Seam Rubber.



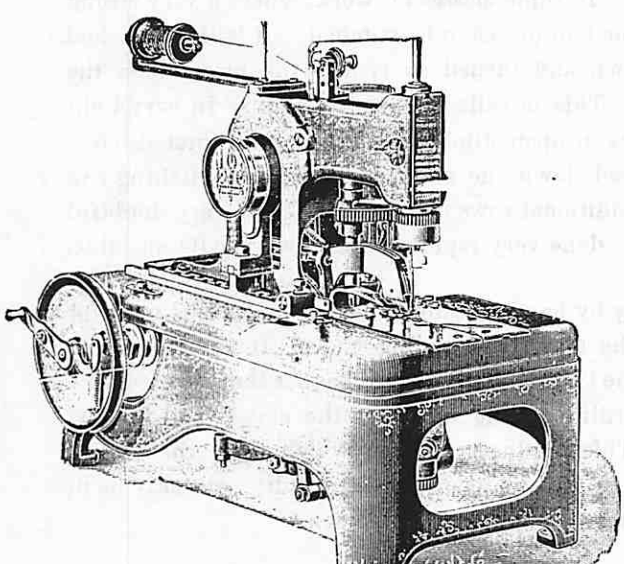
Standard Button Fastener.



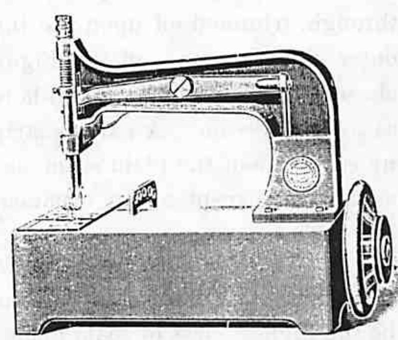
Common Seam Rubber.



Union Seam Finisher.



Reece Buttonhole.



Reece Buttonhole Finisher.

Button Working Machines, by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

practically any kind of material, it is called "The Power Skiver." Another excellent class of machine consists of a rotating knife, which has a similar effect to the band knife, but rotates as a solid hollow wheel.

The folding and turning may be done by machine, of which there are a large number in the market. The process, preparatory to folding, consists of a fine notching or cutting the edge of the upper, to permit of the edge being turned down, as Figure 12, Plate 52. If folded by hand after the notching, it is advisable to mark the exact position to be folded with a dull knife ; this forms a dent. The edge is then pasted or cemented, and turned over with the finger and dull edge of the knife, the dent behind the edge assisting in turning to an exact line.

Folding machines either fold in very short lengths about 10 to 14 to the inch, as "The Lufkin Folder," or fold the whole length of the curve, as "The Power Folder." "The Lufkin" is a very useful machine for general work ; it will fold nearly anything that has ordinary curves. "The Power Folder" folds at one operation to a set shape or template ; it will fold any curve to which a template has been got out, and has had a great effect in modifying the latest systems of closing. With this machine the entire top edge of a low shoe may be folded at one operation ; or the facing of a lace boot or the whole top of the upper after seaming up the back may be folded by one movement. The inside curve of men's whole golosh vamps may also be folded by using a template of the same shape.

The seams which attach these parts are of various kinds and character, according to the requirements of the work.

Raw edges are attached by which are known as "lap" seams—Figures 5 and 6, Plate 52. This seam consists of one or more rows of stitches passing straight through the material, as shewn. If made by a lock-stitch machine, the appearance on both sides should be alike. If made by a loop-stitch machine, the stitch upon the outside would be as an ordinary stitch of short straight lines, and upon the inner side of interlocked loops—See Diagrams of stitches.

Where two edges are seamed together, so that the seam is upon the inner side, it is called a plain seem, as Figure 13. This is produced by first placing the material face to face, stitching through and turning over ; the seam is then as shewn. In some classes of work, where a very strong seam is required, a strip is first inserted between the two pieces to be stitched. It is then stitched through, trimmed off upon the inner side, rubbed down and turned over, and the piece upon the outer side trimmed off, as Figures 14, 15, and 16. This is called a "welt" seam. In very light classes of work, a fancy finish is required, called silking or open stitching. The seam is first stitched as the plain seam. A narrow strip of tape is then placed down the seam, and a row of stitching run up each side of the plain seam, as Figure 17. These additional rows of stitching are of very doubtful advantage, except as an ornament ; they can now be done very rapidly on the two-needle machine.

Another class of seam which is done entirely by hand, is called a flat seam ; this is used for some high-class men's work, and particularly for the tongues of riding boots. It is supposed to be the highest class of seam made by hand closers. The two edges are skived so that they fit precisely. A small groove is cut in one side or marked, according to the desire of the closer, and the awl is passed through and the seam made, as Figure 18. This produces a seam, which upon the outside has no signs of a stitch, and upon the inside holds the two pieces together very solidly ; the skiving of this seam is very important and cannot be done except by a highly-skilled person.

Where two edges are to be placed together so that the actual edges are in contact, as Figures 17, 18, 19, a seam is formed by passing the thread alternately backwards and forwards across the edge of the material; this is called "over seaming," and is done very well by the 32·52 Singer. Another style of seam is where one piece is laid flat against the other, and has to be seamed so that the thread does not pass through anything except the edge of one material, and a portion of the substance of the other. This is commonly used to attach inside fittings, as sidelinings, to stout work; it is called "whipping," as Figure 20.

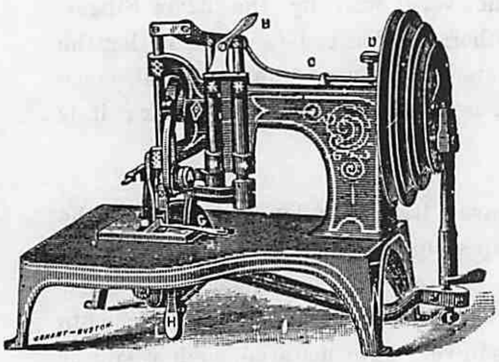
Linings have, usually, plain seams down the front, and have a back strap lap-seamed down the back. In very high-class work it is sometimes the custom to lap seam the front seam of a lining, by laying one piece straight over the other, and stitching through; this produces a stronger, flatter seam than is generally made by stitching and turning and rubbing down. The inside fittings are attached to the linings by lap seams, except in the case of top linings or bands in very light material, such as silk or satin; these are generally placed face to the lining, stitched through, and then turned back to form a fold. The inside lining and fittings are either attached to the outside by a lap seam, which is preferably trimmed off by machine; or they are turned in, forming a folded edge against the outside; or they are turned or bagged against the edge, as previously described.

The parts constituting the outsides in very light work have the legs plain-seamed together; where some embellishment is required, the front and back seams are open-seamed, or silked. The other parts are all lap-seamed, either raw-edged or folded. In very stout work the seams are either welt seams for the back seams, or lap seams for all the others. In fact, the lap seam is the strongest seam known.

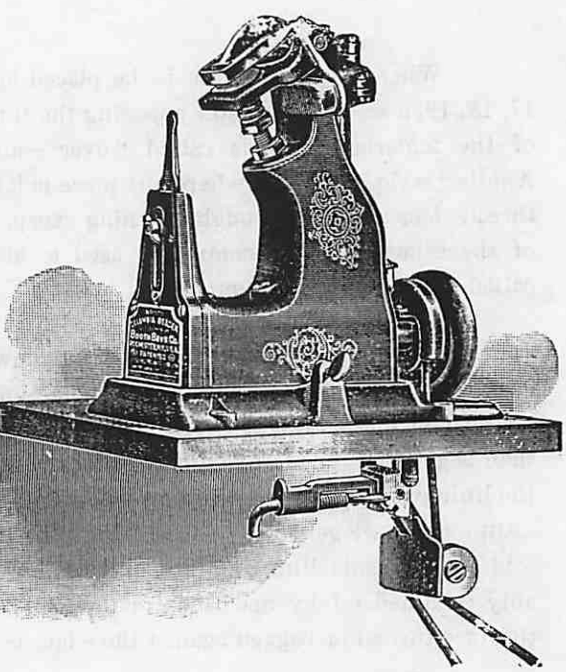
All these seams should be carefully rubbed down, this may be done by hand or machine. The plain seams are usually rubbed by a seam rubber, which consists of a cylindrical iron bar about 18 inches long and 1½ inches in diameter; it is swivelled at one end and has a handle on the other. The collar attached to the end of the bar allows of a rotary motion; this collar is fastened to a pedestal, which has an arm beneath the loose bar of the shape of the part to be rubbed down. The part is put over the arm; the bar is then brought down on the seam and rubbed backwards and forwards; this is a very good method for all plain seams. Machines used for this purpose are "The Rapid" and "The Union."

"The Rapid" is a seam rubber; "The Union" a seam finisher and welt cutter, for a welted seam; both of them do exceedingly good work and are much faster than the hand method. Lap seams should be beaten down with a straight blow and not rubbed, as the rubbing has a tendency to abraid the surface of the stitches; this has no effect on the ordinary plain seam, but in a lap seam, as in vamps for waxed leather work or any part of the edge, the seam should be laid down by a series of blows.

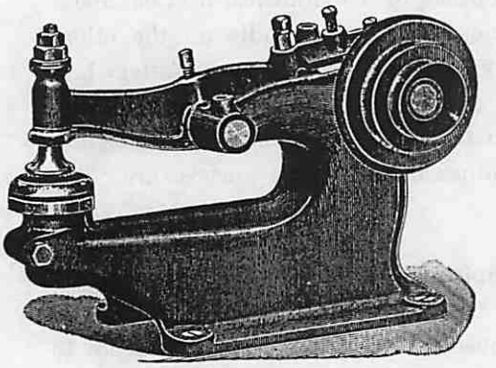
The hand method is called "hammering off," and is done by placing the upper over a dummy representing its shape, and beating the edges with a hammer; it is a very good process, but very slow and exceedingly hard work. The machine method is by a rapidly vibrating hammer, working against a plate which is curved so that the blow of the hammer is only on a few stitches. The strength of the blow is modified by a plate. The pace of the "Paragon" is about 1,200 per minute, the work quite as good as hand work and about four times as quick.



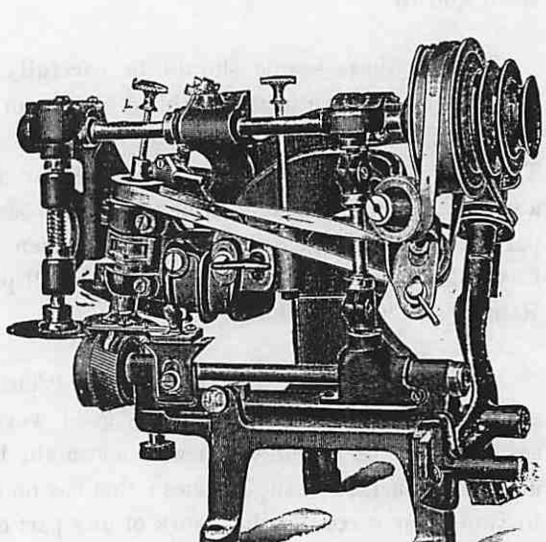
"Lufkin" Edge Folder.



Columbia Beader.



Power Hammer.



No. 7 Friction Feed Amazeen.

Skiving, Beading, and Folding Machines by
THE BRITISH UNITED MACHINERY Co.
Union Works, LEICESTER.

(See Plate 55).

The different kind of stitches commonly used in upper closing are the lock stitch, the chain stitch, the ordinary hand seam, and the button-hole stitch made by machine to finish the edges of button holes. The lock stitch is shewn on Figure 21. It will be seen that the two threads (top and bottom) interlock in the centre. There should be no difference in appearance between the seam on either side. If the stitch in incorrectly made, the loop or lock is pulled through to the side having the greatest tension, and both threads are seen on one side ; this stitch is the most commonly used seam in England for upper closing. The chain stitch, although in common use for stitching the bottoms of boots, and largely used in America for upper stitching, is not in common use in England. This seam (Figure 22) consists of a single thread, which is drawn through and interlooped on one side, forming a row of stitches on one side and interlocked loops on the other. The hand seam (Figure 23) is a single thread seam, made by passing the thread alternately through holes made by an awl ; it has not at present been successfully made by any machine, and is not likely to be.

The button-hole stitch consists of an interlooping arrangement upon the edge of the material ; this may be done in conjunction with a cord, or two ordinary threads ; but the interlooping on the edge of the material forms the essential difference between the ordinary seam and the button-hole stitch.

The shape of the needle or the awl used, has considerable effect upon the appearance of the seam and upon the use to which it is put. Sewing needles and awls are round in their section, they are adapted to sewing the seams upon the inner side of the boots or for woven fabrics. Other upper stitching needles and awls have a chisel edge point, the direction of the cut made by it being determined by the length of stitch and appearance required. Sewing needles should be used for all work such as linings, silks, or other woven makes, and sometimes for very light leathers that are to be plain seams ; they should also be used for stitching elastic sides or Congress boots.

It must be evident that if a series of round holes are made in the material, that the length of the stitch will be decided by the size of the holes. And that if a cut be made instead of a round hole, and the cut is at right angles to the direction of the stitch, that a greater number of stitches could be made than with a round needle. The smallest number of stitches possible would be with a chisel-pointed needle, in which the direction of the cut was the same as the direction of the seam ; it is conceivable that if the stitches were made short enough, the needle would make a continuous cut in the leather. On the other hand, the chisel-pointed needle at right angles to the line of direction of the seam would produce the greatest number of stitches ; between these two extremes all modifications must come.

The different angles at which the cut of the needle is to the line of the seam have various names : when it is at right angles to the line of direction, it is called a cross point ; when it is inclined to the line of direction, it is called a reverse ; when it is inclined from the line of direction, it is called a twist ; when it coincides with the line of direction, it is called a wedge—See Figure 24.

A simple method of closing a top is illustrated upon Plate 53. The lining (Figure 1) is seamed down the back AB, and the inside facing stitched up CD. The back leather (Figure 2) is stitched from A to B, and then run off the edge of the lining to C, this leaves a loose back leather from B to D, which is a great advantage in lasting the boot. In the meantime the legs have been

closed down the back, as Figure 3; the seam rubbed down and the facing row stitched as AB; the loop is then inserted as A, Figure 4, and the leg stitched to the top of the leg of the lining, as BC. This, on being turned down, presents the appearance of Figure 5. It should now be stitched from A to B, B to C, C to D, using the Singer trimmer to trim off the inside facing. It will now be ready to seam up the front lining and attach the golosh vamp; it should now be punched, eyeletted, and barred. The best results are obtained by fitting on the block. We therefore next seam up the lining, as Figure 6. The upper is then placed upon the block, as Figure 7, and the golosh having been previously seamed up (Figure 8) is placed over the block (Figure 9), the tongue slipped in and the golosh is exactly level with the allowance of seam at the back. Keeping it precisely in position, draw the front of the golosh over the upper, place it on the front of the facing row just above the stay, with the pinchers draw the centre of the toe until the edge of the golosh is level with the marking; put a tack in the toe, take hold of the side of the golosh at the point B, and draw forward from the point C until the golosh is quite clear along the counter; tack all round, take out the tacks and the golosh is ready for stitching.

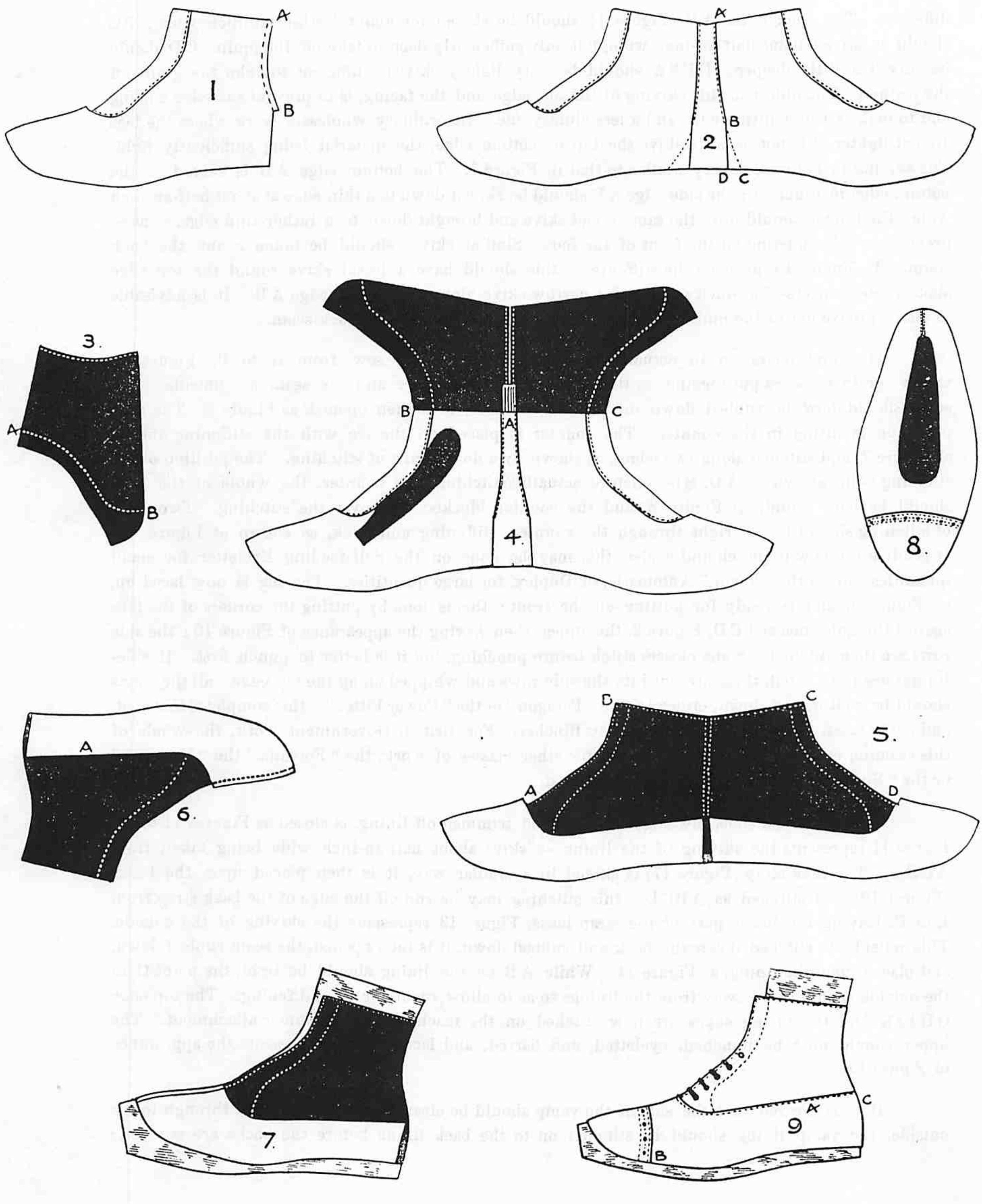
An alternate method is to take the upper at Figure 6 and put the golosh over the top, with the back seam of the golosh exactly in the back seam of the top; place the two, held firmly in position by the fingers, upon the Singer golosh machine, and commence stitching from the point A; put in about six or eight stitches, see that the golosh is exactly to the awl holes or markings, now stitch straight along round the front of the golosh to the opposite side, be careful to keep the golosh against the proper markings and continue until you reach the point A.

The principle explained may be applied to several kinds of uppers. The lining might have a top-band which would be stitched to the top edge of the boot. The outside might be cut to fold down to form its own top lining on the inner side of the boot, as Plate 26. This would make no difference to the method of closing, but simply a difference in the routine of stitching the uppers. If the goloshes or vamps were lasted on, it would make no difference whether they had back straps (commonly called Boston backs), or jockey backs or not. I cannot advise Boston or jockey backs being held on. There appears no saving in point of time, and the work produced is not good. If the boot was a leather-lined boot, there would be no inside facings or back strips to stitch on; in that case the seam would finish where the seam of the linen lining finished. The other part of the process would be precisely similar.

If the outside of the leg were folded along the facing and across the top, it would be necessary to lay the outside straight down on to the lining; this may be done by the holding-on method, or much better, by fitting round the block, as shewn on Figure 10, Plate 53. Presuming that the front edge and top were turned by the power folder, and the stitching done on the Singer machine with trimmer, there would be very little difference between the cost of the two methods. The goloshed vamps, whether joined or stitched, or with Boston backs, would be fitted precisely as before, either by being held on or stitched after lasting.

The Blucher boot for army trade is usually closed by hand, but it is highly probable that any heavy machine work would be nearly as effective. The Diagrams upon Plate 54, explain the methods of closing. The edges should first be skived, as Figures 1 and 2; for this purpose the "Carver" skiver or the "Amazeen" skiver may be used; but some difference should be made in the depth and the angle of the skive, the object in the skivings for the various parts being entirely

Plate 53.



different. The back seam AB (Figure 1) should be skived for about 1/8th-of-an-inch wide; BC should be skived about half-an-inch wide, but only sufficiently deep to take off the grain. CD should be skived a little deeper; DEFA should be very lightly skived, sufficient to take the grain off the leather. The object in this skiving of the top edge and the facing, is to prevent the edge curling and to make a better fitting edge and a less clumsy one. In ordinary wholesale work where the legs are cut lighter, it is not usual to skive the top or bottom edge, the material being sufficiently light. The skiving in Figure 2 is very similar to that in Figure 1. The bottom edge AB is skived as the bottom edge in Figure 1; the side edge AB should be skived down to a thin edge at about half-an-inch wide; the tongue should have the same broad skive and brought down to a rather thin edge, so as to prevent the edge hurting on the front of the foot. Similar skives should be taken round the back counter 3; Figure 4 represents the stiffening; this should have a broad skive round the top edge about three-quarters-of-an-inch wide, and a narrow skive along the bottom edge AB. It is advisable to take a groove out of the middle of the stiffening as C, to bed into the back seam.

The first operation in actually closing this boot, is to sew from A to B, Figure 5; the two grain sides are put together so that the face of the leather and the seam are outside. The seam should now be rubbed down on the seam rubber, it is then opened, as Figure 6. The next operation is fitting in the counter. The counter is placed on the leg with the stiffening inside, as Figure 7, and stitched along two edges, as shewn by a double row of stitching. The position of the stitching being shewn at AD, BD. Before actually stitching this counter, the whole of the back should be bent round, as Figure 8, and the counter blocked well over the stitching. Two rows of stitching should be put right through the counter, stiffening and back, as shewn at Figure 7C. It is advisable now to punch and eyelet, this may be done on the Self-feeding Eyeletter for small quantities; or on the "Twin," Automatic, or Duplex, for large quantities. The leg is now laced up, as Figure 9, and is ready for putting on the front; this is done by putting the corners of the tabs against the holes marked CD, Figure 2, the upper then having the appearance of Figure 10; the side rows are then stitched. Some closers stitch before punching, but it is better to punch first. If side-linings are to be fitted, these are put into the side rows and whipped along the top edge; all the seams should be well beaten down, either by the "Paragon" or the "Power Fitter"; this completes this boot, and is the usual method of closing the army Blucher. For British Government work, the whole of this seaming is usually done by hand; but for other classes of work, the "Fortuna," the "National," or the "Singer" waxed thread machines are used.

A leather-lined shoe, raw edged outside and trimmed off lining, is closed as Figures 11 to 19. Figure 11 represents the skiving of the lining—a skive about half-an-inch wide being taken from ACDE. The back strap (Figure 17) is skived in a similar way, it is then placed upon the backs (Figure 12) and stitched as ABCD; this stitching may be run off the edge of the back strap from E to F, leaving the lower part of the strap loose, Figure 13 represents the skiving of the outside. This outside is stitched down the back and rubbed down, it is then opened, the seam rubbed down, and placed upon the lining, as Figure 14. While AB on the lining should be tight, the point C on the outside should stand away from the linings so as to allow room for the stiffening. The top edge GHIJK and the facing edges are now stitched on the machine, with trimmer attachment. The upper should next be punched, eyeletted, and barred, and laced up, and presents the appearance of Figure 15.

If it is desired that the side of the vamp should be clear, that is, not stitched through to the outside, the vamp lining should be stitched on to the back lining before the backs are stitched;

a short cut would then be made, as AB, Figure 15, and the lining drawn back. The vamp would then be placed over the backs, as Figure 19, and stitched across from A to B; the lining would then be drawn down on the inside and the tongue whipped in.

If the vamp stitching was to go right through lining and outside, when the backs reach the stage shewn at Figure 15, the vamp lining at 16 would be put between the lining and the outside, and the vamp placed over it. To do this it would probably be necessaay to cut the vamp lining at A, so as to pass through the corners of the facing, the vamp being fitted as Figure 19. In this case when the stitcher reached point A (Figure 19), she would insert the tongue, stitching it in its place with the vamp rows. This completes the ordinary shoe. The edges may be set up with an edge setter, which gives it a greatly improved appearance.

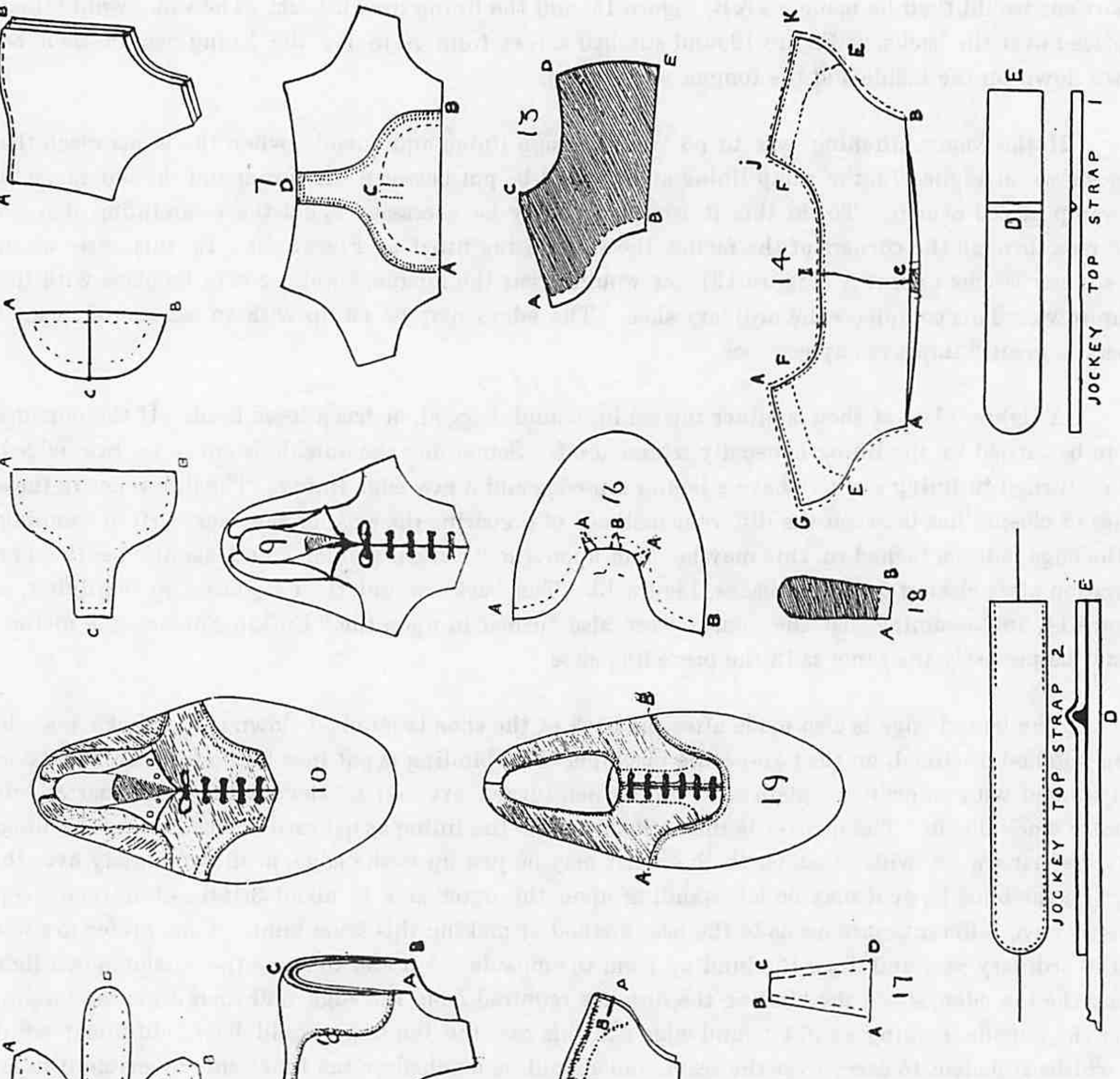
A lighter class of shoe is either turned in, bound, bagged, or has a loose bead. If the outsides are to be turned in, the lining is usually trimmed off. Sometimes the outside is cut to be raw edged, with a turned in lining; others have a bound top edge and a raw edge lining. The difference in these styles of closing lies between the different methods of preparing the edge of the backs before vamping. If the edge is to be turned in, this may be done upon the "Lufkin Folder," and should be the first operation after closing down the backs, Figure 13. The backs would then be fitted on the lining, as Figure 14, and assuming that the vamps were also turned in upon the "Lufkin Folder," the method would be precisely the same as in the preceding shoe.

The bound edge is also made after the back of the shoe is stitched down; the backs may be open stitched or silked, on the two-needle machine. The binding is put face to the face of the outside, and seamed with an ordinary plain seam; it is then turned over on to the inside of the quarter, and usually stuck down. The quarter is then stitched on to the lining as before described; these bindings may be narrow or wide, that is, the bead left may be just up to the edge, or drawn closely over the edge on the outside, or it may be left standing upon the outer side to about 3/16ths-of-an-inch deep. Closers have different opinions as to the best method of making this wide bind. Some prefer to stitch in the ordinary way and draw the bind up from the outside. I prefer to skive the outside down light along the top edge, stitch the binding the distance required from the edge, and then draw the binding over the outside, making a solid bound edge; in this case the binding should have additional width or widths sufficient to carry over the seam, and should be notched on the inner side to enable it to lay down flat. After the binding is turned and stuck down, the remainder of the process is as described before.

The folded or turned in edge may be done on the "Lufkin," or at one operation on the "Power Folder." It is usual to have two or three templets to a set of shoes, *i.e.*, the machine turns the whole of the shoes into two or three shapes or sizes of the same shape. Although this is nominally so, it is found in practice that the operator can considerably modify the curve by drawing the edge, that is, presuming that in Figure 13 it was desired to fold the top edge ACD, and that the line of the "Power Folder" was less curved than the line CD, the operator, by drawing CD slightly apart, would fit it to the "Power Folder" while it was being operated upon, and it would go back to its original shape CD, after being taken off the folder; of course, in actually folding, the whole shoe back could be folded at once, as Figure 14. It would be stitched precisely the same as if turned in by the "Lufkin," or turned by hand, or raw edged. If it was desired to turn in the front for quarter over vamp, it is advisable to put a stay or bar across the bottom of the quarters, and to punch and eyelet.

To face Page 110.

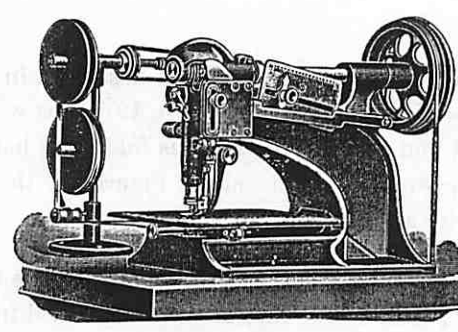
Plate 54.



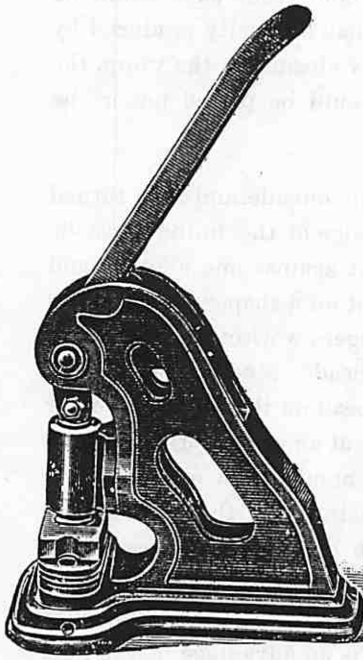
Fitting Shoes and Bluchers.

To face Page 111.

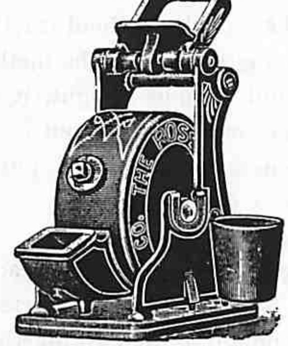
Plate 55.



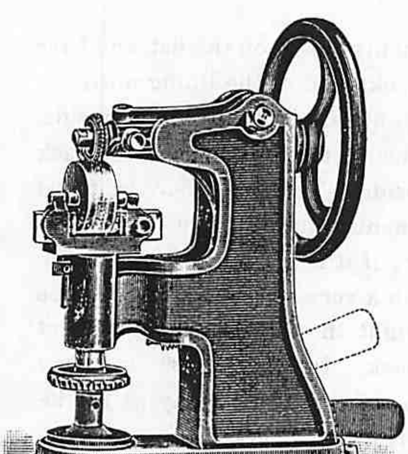
"Royal" Perforator.



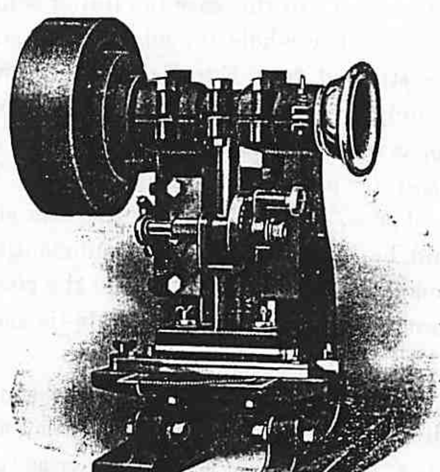
Perforating Press.



Ross Cement Pot.



"Ideal" Scolloping Machine.



Power Tip Press.

Scolloping and Perforating Machines by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

(See Plate 62).

By drawing back the lining as described in reference to Figure 15, the whole front edge could be turned in from A to B (Figure 19); this would produce a far better curve than is usually produced by hand, but usually, the front is folded by hand or the "Lufkin." In actually closing on the vamp, the vamp would be of the shape Figure 16, that is, with the seam on, and would be placed under the quarter and stitched through.

Bagged shoes are stitched with the face of the lining to the face of the outside, and then turned over; in this case care must be exercised in cutting the pattern. The top edge of the lining must be the same shape as the top edge of the outside. The two are then placed against one another and stitched along the top edge; they are then turned right side out and put on a shaper. The actual edge may be shaped by the "Columbia Beader," which consists of two fingers working upon a pivet, with a beader which presses the stuff down over the fingers and forms the bead. Much depends upon the relative shape of the outside and lining as to the proportion of the bead on the inner and outer sides. Commonly, the seam is drawn down on the inside of the lining about an eighth-of-an-inch, so that the outside forms a narrow strip along the top edge of the inside, and another row of stitching is run along the top edge to hold it; this forms a very nice finish. The remainder of the closing may be done upon either one of the methods previously described. In each one of these processes where the lining and outside is light, it is advisable to put a facing stay along the inside facing. In some cases a swansdown backer is put between the lining and the outside, this should be stitched up with the back seam and facing seam, but not quite to the top edges, although it is an advantage if it is held by the top row of stitching.

Edges that have a loose bead inserted between the outside and the lining have, generally, to be fitted: that is, have the bead inserted by hand when the outside is stuck to the lining. Some stitchers are clever enough to hold all together, but unless a special machine with bead-feeding attachment is used, it will be found advisable to stick the bead.

Court shoes, as shewn upon Plate 24, Figures 1, 2, 3, are commonly closed on the flat, and have their back seams made last. Many manufacturers do not close the back seam of the lining until the last operation: in this case the lining is first made as Figure 3, opened out, and laid under the outside, Figure 2. The whole top edge is then stitched; the outside is then turned face to face, and the back seams stitched from E to F; the lining would then be loose on the inside. This seam may be made separately by machine or hand, but as stated before, a great many manufacturers leave the linings loose, as that is the simplest way to get a clear lining after the turning; if it is not left loose it has to be carefully pleated. Figure 5, Plate 24, is a bar shoe; this is closed in a very similar manner to the Oxford shoe. If it is required that the side should not be stitched right through, then a short cut should be made in the lining sufficient to permit of it being drawn back. In the ordinary way they are made "stitched through," and the closing of the front is done precisely the same way as in the Oxford. The closing of the double-tie shoe (Figure 4) does not differ from the court.

Some of these long quarter shoes without fastenings have a loose galloon binding; this binding is put on as a final operation, although one side of it may be stitched to the outside before making, much in the same manner as the binding described for an Oxford shoe. After the shoe is made and turned, the galloon binding is seamed on the inside of the lining, at the same time a piece of thin cord or catgut is enclosed in the binding, so that the two ends of the cord come out of an opening at B, Figure 2, Plate 24. As a final operation, this cord is drawn tight and tied in a small knot; the

galloon is drawn over the knot and felled down, and a small silk bow is placed over the join in the binding.

The sticking on of facing and button stays and backers is done as a preliminary operation to folding, or may be done afterwards, but as the method is identical need not be repeated for each method. All light work should have strips cemented up the parts that require making up in substance to carry eyelets or buttons.

The process of closing a boot on the flat is sometimes referred to as fitting from the front. The top-bands are first stitched on the lining and the facings stuck on. The front seam is then seamed down; the legs are next pasted in their position against the inside facing and top-bands. The backs are then stitched from the edge of the facing to the back corner of the leg. The next operation is stitching the facing. The upper is now ready to be vamped. If they are whole golosh vamps, the vamps may be fitted straight on to the legs, putting the tongue in to be held by the vamp stitching; if they are joined golosh, the side seams should be made first. The vamp is now stitched either quite round from corner to corner, or to within about an inch; or the back golosh may be stitched first and the vamp put over. The back seams are now stitched. By first stitching the outside, the linings may then be laid flat over one another at the back, and the back leather with the strip of back loop between, placed over them and stitched right through the outside and back loop or leather. If the goloshes were stitched right through to the corners, they would have to be stitched down with the back seam of the leg. If they were left loose, they would first of all be tested to see that they were of the correct length, and the back seam made so that they fitted round the legs. The short length remaining at the back upon each side of the centre seam would then be laid flat on the machine and the seam completed. This is probably the lowest form and the cheapest form of closing a man's top.

In a really good class upper, the parts having been skived, the lining first has the top-band stitched on to it; then the back leather; the facing is next stuck on in its correct position. The outsides are then seamed up the back and rubbed down; they are next bound or folded, as the case may be. The lining is then placed over a block, which is made to exactly fit the standard pattern, and pulled tightly round to get it into its correct shape; the leg is then fitted on to the lining, sufficient paste or cement being used to hold it firmly in its place. If it has an outside back strap that is also fitted on, the back loop is placed between the lining and the outside, the back strap is stitched right through outside and inside back leather, and the top edge and facing stitched. The tongue is either caught by the facing row at the side, or a special short row of stitches is put in to hold it. The next operation is to seam down the front of the lining; rub down the lining seam and put the tongue in its correct position. The upper is now put over the lasting block, and the goloshes or vamps having been previously seamed up, are lasted, as explained in reference to Plate 53. With the edges beaten up as previously described, this makes a very solid method of closing, and produces an upper which is nearly the form of the last that it is to be made upon, and which represents the original shape of the pattern produced by the designer. Seeing that there are so many rights and lefts patterns used now, and that there appears to be a desire to shape the uppers before they reach the laster, it would certainly be an advantage if rights and lefts blocks were used, so that the curves at the front of the vamps were produced of the correct shape before the final stitching. Under the present system it is quite common to see uppers cut from patterns designed for rights and lefts closed upon blocks that are both sides alike, and which destroy much of the design of the pattern-cutter.

The Blucher-fronted boot, or Derby, is generally considered a rather difficult boot to close, but if carefully closed from the back, with the parts cut to fit accurately, there should be no real difficulty in the matter; although the services of a good stitcher will be required in some parts. The top edges may be prepared as in other work. Figure 1 is the representation of a partly bound top edge, shewing the binding stuck down up the facing, but loose along part of the top. The parts should be skived as described for other skiving. The first operation will be closing up the back seams of the outsides: these will have an ordinary plain seam; the outside back straps are next stitched on; the leather linings are then closed up in a similar manner, and generally, open stitched on the Singer two-needle machine. The backs are then laid upon the linings, the loop inserted between the lining and outside, and a row of stitching made from the corner of the tab up the facing, along the top and down to the opposite corner. An extra row of stitching is generally run straight along the top over the loop, carried down the side of the back strap and along the counter line, stopping at the point shewn. The vamps, in the meantime, if cut with toe joiners, have had the toe joiners stitched on and the caps stitched through. The vamp lining is now placed upon the vamp, and the tongue put between it and the outside, it is then stitched from corner to corner, care being taken to put the corner of the tongue quite down to the corner of the vamp. The tongue is now turned up from the corner, as illustrated on Plates 28 and 29. The side of the back is now laid on the vamp, with the vamp lining in between the outside and the lining, a cut being made in the lining to admit it passing through. The side seam of the vamp is next stitched; the tongue is placed against the facing marking, and the facing stitched down to the counter row, fastening the tongue down to the corner; the facing row is now carried to the corner of the tab and connected with the vamp rows of stitching.

The next operation is to place the opposite side of the vamp between the quarter and the outside with the vamp linings, and to stitch the side seam of the vamp; this requires a considerable amount of skill if held together, and the greatest care should be taken to fit the corners of the tabs to the marks made to indicate where they would come. The tongue is turned up as upon the opposite side, and the facing row and side seams stitched in the same manner. This stitching is best done on a cylinder machine or a post machine—preferably a post machine—which admits of the boot being turned about to suit the style of closing. The method described here assumes that the vamp lining is cut separate from the back, and that the tongue is fitted underneath the vamp, or between the vamp and the lining.

Some closers prefer to fit the tongue on top, which as a matter of fact, makes the best water-tight boot. In this case the tongue being stitched on the top of the vamp, would be simply folded down from the corner, so that the corner pieces at the end turn underneath the corner of the vamp, helping to hold it down firmly or closely, and preventing the possibility of the corner slipping back and leaving an aperture at the corner of the tongue; a common fault in Blucher-fronted work. The other part of the stitching does not differ from that described. If the lining is cut in one piece, it must either have an inside facing—the tongue must be brought up to form the facing; or it must be cut as Figure 4, Plate 29.

Some closers prefer to have the lining cut in the ordinary way, and to cut forward from point F, Plate 59, and straight across; this leaves a square opening, which has to be covered by the tongue. In that case the tongue has to be stitched across the opening, after the front of the lining is seamed down; the vamp is then laid on so that the cut in the tongue comes exactly with the corner

of the wing of the vamp, and being turned at that corner, admits of it being stitched in precisely the same way as described before. If the tongue is cut to form the lower part of the facing, the lining may cover the tongue upon the under side of the vamp, between the corners of the tabs. In that case, after seaming up the front of the lining, the tongue would be placed between the lining and the vamp which would be fitted down in its correct position in relation to the backs, and a row of stitches run across from corner to corner ; the side seams of the vamps would then be stitched as described before, and the facing rows finished in the ordinary way. Some stitchers prefer to stitch the facing rows before stitching the side seams.

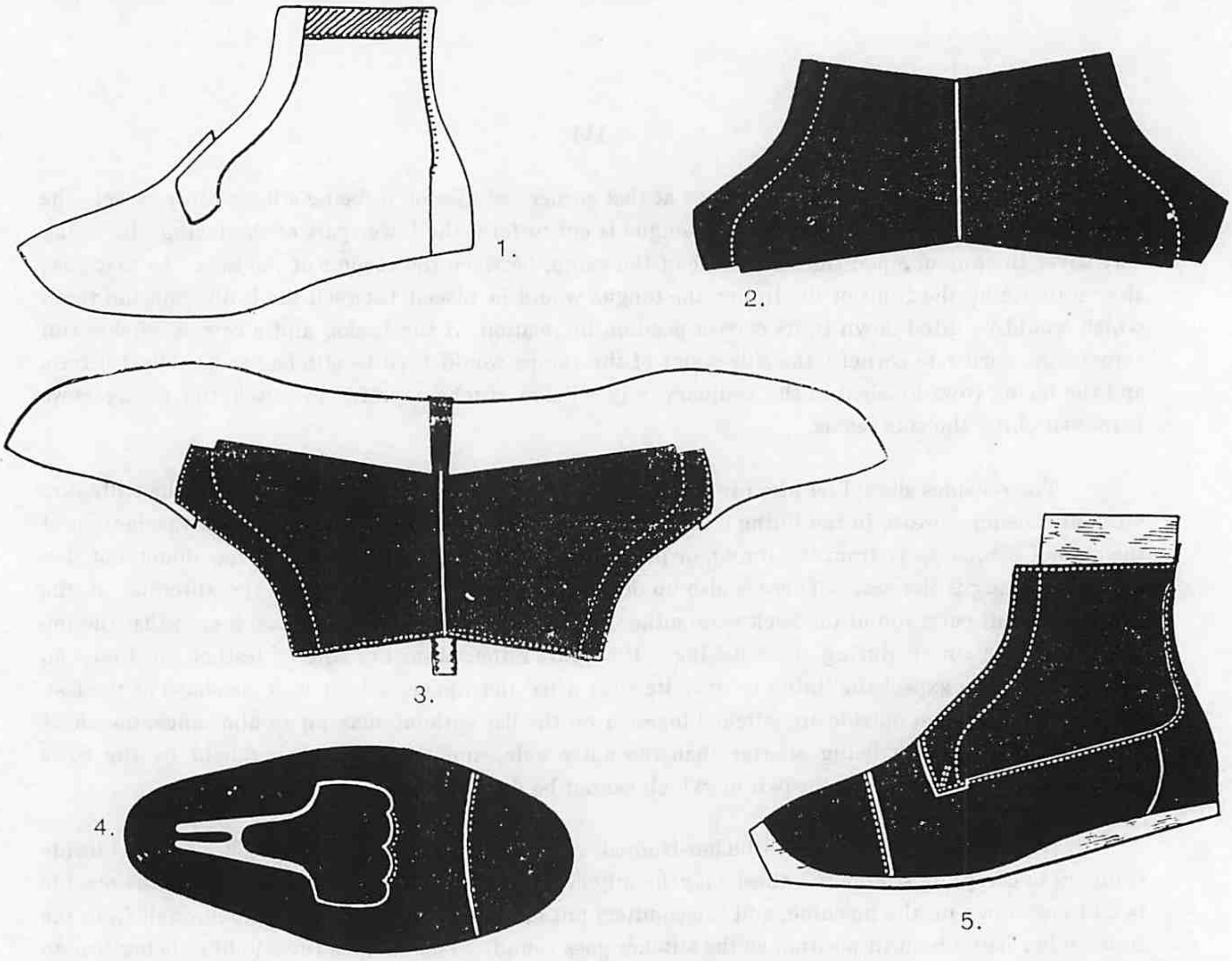
The outsides should be fitted to the linings so that space is left sufficient to take the stiffening without causing a crease in the lining ; this may be done on the flat by fitting so that the bottom of the outside stands away from the lining, or preferably, on a block. There can be no doubt but that the block fitting is the best. There is also no doubt that it is much better to do the stitching of the counter and all parts round the back seam either on a cylinder arm or a post machine, so that the top is kept on the round during the stitching. It appears rather absurd to stitch a leather-lined boot on the flat, and then expect the lining to sit quite clear after the upper is bent into the shape of the last. Where the lining and outside are stitched together on the flat without making an allowance, the effect is, that the inner side being shorter than the outer side, and the lining being held by the rows of stitching, ugly creases are thrown up which cannot be drawn out by the laster.

Some classes of heavy Blucher-fronted work are unlined, but are fitted with inside counters to carry the stiffeners ; these may be stitched from the inner side, that is to say, the outside is laid face down on the machine, and the counters put on the top and stitched right through from the inner side ; being held in position as the stitcher goes round. This insures the stitching being true to the edge of the counter, without the outsides having to be marked. The backs being stitched in this way, the tongues—usually big water-tight tongues, are stitched up the front facing before being stitched to the vamps. The vamps are then placed in position and stitched to the tongues ; they are then stitched down the side seams. The corner of the tongue and the corner of the tab are often fastened together by additional fastenings in the shape of metal studs or special rows of stabbing ; the stabbing or studding should be arranged to include the corner of the tongues and the corner of the wing of the vamp, so as to make it thoroughly water-tight.

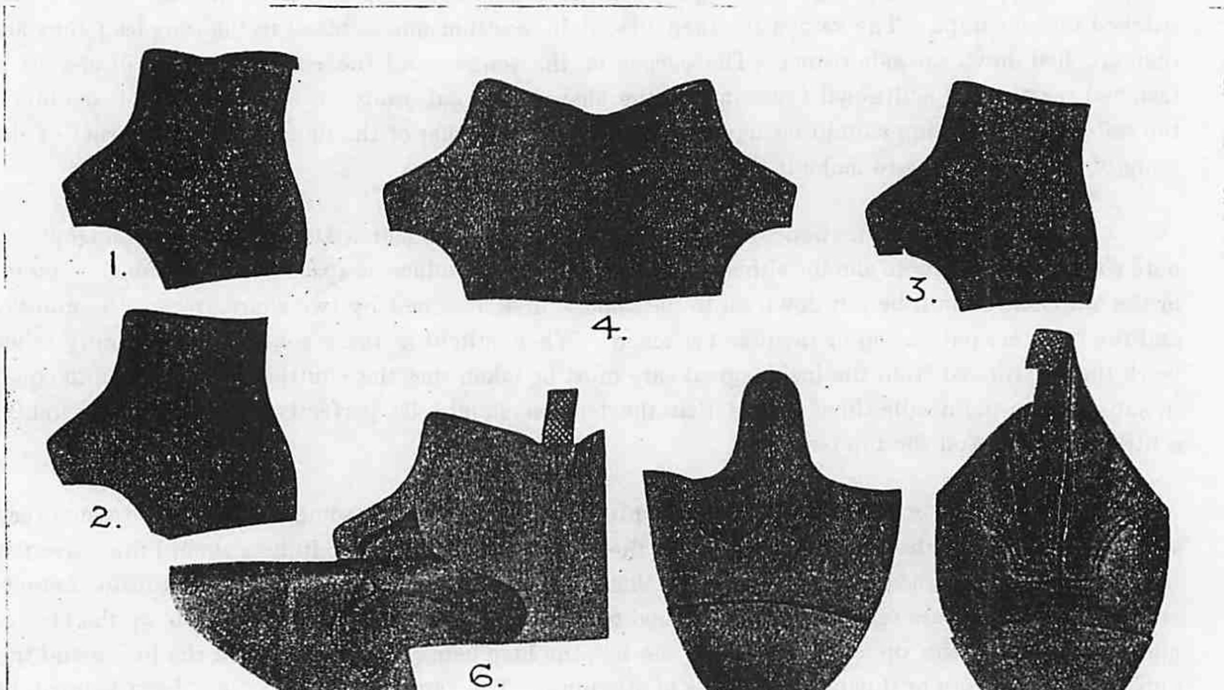
The precautions mentioned when describing the closing of a Derby should be remembered here ; the inside counters should either be drafted so as to produce a space for the stiffener to go in, or the stiffeners should be put down on to the outside first, fastened by two short rows in the middle, and the counters put on top of them and stitched. When stitching these counter rows or any other work that is stitched from the inside, great care must be taken that the shuttle threads are quite equal in substance to the needle threads, and that the tension should be perfectly correct, or preferably, a little extra tight on the top tension.

The open tab golosh boot or Derby-fronted golosh boot, as it is sometimes called, presents very similar difficulties to the ordinary Derby. If the boot is to be fitted, the linings should first have the backs seamed and rubbed down, as Figure 1, Plate 56. The top-bands are stitched and inside facings stuck on. The legs are seamed up and stitched to the linings from the corner of the tab, up the facing, along the top, to the opposite corner of the tab, the loop being inserted between the lining and the outside, either before or during the process of stitching. The vamps have, meantime, been seamed up

Plate 56.



Open Tab or Derby Fronted Goloshed.



Derby or Blucher.

the back ; the toe joiners and toe-caps seamed on, and the tongue stitched across from corner to corner. The legs having been closed to the linings, the top is now placed over a block and pulled into place, being held by two tacks—one at each corner of the toe ; the golosh is next placed with the back strap exactly in the centre of the leg, in its correct position in relation to the marks along the counter, and then pulled into place at the front. The goloshes should be cut a little tight in length, to admit of a slight stretching into place ; after they are set they are taken off and stitched. The tongue is now turned up and the facing row stitched. The corners of the tabs are next finished by having the two short rows, and the extra row to the corner of the tongue stitched ; commonly the corner of the tabs are very weak, owing to the seam having to take the full pressure when the tabs are open upon its weakest part, *i.e.*, nearly at right angles to the direction of the seam. To secure the tab against strain at this part, it is advisable to put a row of stitching at about the same angle that the tab is commonly opened, so that any pressure against the corner of the tab is sideways against the seam.

If the vamp is to be held in place during stitching, the tongues should either be closed in with the facing or be cut to form the facing. In either case, the stitchers now place the vamp so that the back seam of the golosh, or the back strap, as the case may be, is exactly in the back seam of the leg. They then commence stitching at the side of the counter, at about 3 inches from the back seam, making sufficient stitches to hold it in its place. The stitching is carried on in lengths, according to the skill of the stitcher, to the corner of the tab ; and then a fresh row is made between the corners of the tongue.

Seeing that the least irregularity in the position of the golosh would all shew at the corner of the tab, and that it could not be worked away at this point, it is very doubtful whether the holding-on method is really economical in the case of golosh Blucher work. It appears that it is quite as profitable to last the goloshes on.

There is a great difficulty in this design, owing to the corners of the tabs not looking quite alike. In England, we commonly use the wheel feed for this style of work, and this feed naturally pushes the material before it, there is a tendency for the golosh to draw from the point you start at and to push out at the finishing point. It is quite certain that for a great deal of our stitching, where we use soft material, we should use the four motion or step feed ; this would lift the work along, would not stretch the seams, and would make better uppers.

Some low classes of open tab work are fitted from the front, or strictly speaking, they are closed upon a combined method ; the legs and backs are made as previously described, and the tongues fitted in and stitched to the facing and straight across the lining, a rather long cut being made at the side, to admit of any irregularity in the fit of the vamps and the tongues. The vamp is now laid straight on to the front, stitched across from corner to corner of the vamp, and then stitched from the corner of the tab straight along each side, leaving the back seam open. The back seam is then finished as described in fitting ordinary lace boots from the front ; this method does not produce a good shoe, but it is a very simple method.

Where a straight tongue if used for open tab boot, with a leather lining that is joined across the front, this combination method may be used with advantage, the tongue being stitched to the vamp, or between the vamp and the lining ; the vamp itself can be drawn underneath the legs and stitched straight back on both sides, finishing as described before. If the boot has a Boston back strap and it

is desired to stitch in this manner, the side seams must be made last—that is to say, the fronts are stitched on as described, to within about an inch of the side seam ; the backs are then stitched on, also within about an inch of the seam. The length of the two side seams is now tested and closed up by a plain seam, the last operation being finishing the short row left on the two edges ; this does not make a good job, but it is simple, quick, and does not require any high skill.

Ladies' laced boots, which we will assume to be cut much as illustrated on Plate 26, may be closed upon a similar principle to men's work. Assuming that it is to be a raw-edged outside, or to have an inserted bead, the first operation will be skiving and beading the outside ; the linings would then be seamed up the back, a strip of webbing being run down by the Singer 62·13. These lining seams may very well be made by the chain-stitch machine, in which the threads are run from reels instead of from a shuttle bobber, and which are a great saving of time and much faster than ordinary lock-stitch machines. The top-bands and inside facings will next be stitched on and the lining of the boot will be made. The back seam of the outside is now run down and silked, or open-stitched if it is required, or a back strap run up it. If it has back counters, these back counters should also be seamed and stitched on to the legs, producing a design as Figure 3, Plate 26. If facing stitching is required these are now made.

The vamps will now have been folded or beaded, the quarters would also be beaded and would then be laid down straight on to the outside, either being temporarily fastened by paste or cement, or held together. It is usual to run a short row at the side of the facing to hold the tongue ; the vamp is now placed on the top of the quarter and stitched right through, the end of the tongue being drawn into place as the row of stitching passes across. If the side of the lining is required to be clear, that is, the side seam of the vamp is not to be stitched right through the lining, a short cut must be made in the end of the facing, permitting the lining to be drawn back clear of the vamp rows of stitching, leaving the centre of the facing to form a stay in the middle of the vamp. In this case the tongues may be whipped after the vamps have been put on, so that the cuts made in the facing will be hidden by the tongue, or the cuts in the facing may be made sufficiently wide apart to admit of the tongue being stitched in ; this is a matter of detail, which, although of not very great consequence, causes a difference in method in various classes of work. Some closers finish the facing row before stitching the bottom, allowing the whole lining to be turned back.

If the boot is to be bagged or turned down at the top, it will be closed in a similar way to that described in men's work. Assuming that it is a folded front, and that the top is to be turned down on the inside to form a bead or top-band, and that the inside facing is to be trimmed off by machine, the linings will be first made as described before. The outsides would then be stitched up, but care must be taken that the stitcher does not spoil the shape of the back seam ; this seam should stand out to a sharp point at precisely the place where the top is to fold over ; the top edge of the outside should be smaller than just below it, in proportion to the depth of the fold or turn. The top is now laid face to the lining and stitched to the top edge of the lining, or to the top edge of the top-band, as the case may be ; it is then turned over, and either pushed out on a power beader or shaped out on a shaper, it may then be held down to the facing and stitched up, or it may be pasted to the facing and stitched. The row of stitching may be carried straight across the top, to hold the top edge, or it may be left plain. By this holding-on method, if there is a fancy outside facing, it must be stitched before the outside is closed to the lining, or two rows of stitching will come through the inside facing. If the inside facing is pasted on, then the outside facing rows may be stitched right through the outside

lining and facing, and the side of the tongue caught at the same time. This would complete the back, the vamp would be attached as before.

It is not usual, but it is quite possible, to bag the whole top of a laced boot, that is to say, the lining being cut true to shape, and the outside being laid face down upon it, a row of stitching is run from the edge of the facing up to the leg, along the top, and down the other side of the facing. The top would now be turned right side out and pushed down into shape ; this should certainly be done on a shaper, preferably of metal, with a distinct edge ; another row of stitching would now be carried straight along the edge, and the top would be complete. The remarks made in reference to the facing rows in the previous method of closing, apply to this.

Seeing the speed at which edges may now be folded, it appears scarcely worth the trouble to bag an entire top. The liability to stretch out of shape is always great, and the result is never quite satisfactory. The "Lufkin Folder," the "Power Folder," and the "Urquahart Beader," have removed much of the advantage derived from the old method of bagging, although there is no doubt that considerable advantage is derived from the turned down top.

The lining of a button boot is seamed up very much the same as the laced boot, the difference being that the button fly lining is stitched up the front seam of the lining. The outsides are now stitched down the back and the button piece seamed on, this may have been folded or beaded before stitching on. If the button fly has been beaded with a loose bead, and the top bands are to be turned in, the outsides are now laid flat down on to the lining, so that the top-band stands above the top edge of the outside by about 1/6th-of-an-inch. The edge of the top-band is nicked all round at about 1/8th-of-an-inch apart or less. A dull knife is run round the edge of the top of the boot and the edge of the top-band, and the under side of the leg cemented or pasted for about a quarter-of-an-inch wide. The top edge of the outside is also cemented or pasted. The top-band is now turned down under the edge of the outside, leaving a bead either exactly level with the outside or just above it. When this is turned in right across the top, the button flys are stuck down to the fly linings. The outside is now stitched up the edge of the quarter along the top and round the flys. If there is an open seaming down the front, it may be taken right through the outside and lining, making a very strong job.

Some manufacturers prefer to have the buttons sewn on before the upper is stitched, in this case the buttons will be sewn through the button stay before the flys are stitched on. After the stitching is completed, the button holes are made either on the "Singer" or the "Reece." If on the "Singer," they are first put face down and clamped in the machine. If on the "Reece," the machine also cuts and stitches. The button holes are now barred—See Button hole making. A bar is put across the bottom of the button fly, holding it in its correct position in relation to the outside quarter, and the top is buttoned up. The vamps are now put on and stitched in the same manner described before.

Button work admits of a variation in the get up, precisely the same as laced work, and it is naturally more adapted to the bag system than laced boots. This class of work is rendered much easier than formerly by machine baggers and beaders. If the button boot is to be completely bagged, no attempt must be made to have scollopped button pieces with absolutely sharp corners. It is preferable that straight button pieces should be used, but if scollops are required, they should either be reversed scollops—that is, with the points of the scollops outwards, or the scollops should be cut

in curves, more approaching to a waved line than to actual scollops. The method of closing is similar to that described when dealing with a bagged laced boot. The linings, top-bands, and button fly linings, are first seamed together. The outsides are then seamed up the backs and down the fronts, or they may be open stitched or silked down the back at this stage, and afterwards stitched right through up the front on the " Singer two-needle machine."

The closing of this boot with an open stitched front seam makes it advisable to silk the front seam before stitching the outside to the lining. Seeing that the whole of the top has to be pushed into shape from the inside, either by a shaper or by the boot bagger, it is evident that the whole of the space between the lining and the outside must be clear. Therefore, no rows of stitching should pass quite through.

The outside being stitched to the lining, the whole top is now turned, pushed into shape by hand or by the " Columbia Beader "—See Folding and Beading Machine. The buttons should next be attached, the button holes worked, and a stay put across the bottom of the button fly. The top should now be buttoned up ; the lining pulled clear by passing the hand inside and drawing the lining forward, and the boot vamped as described before.

A turned down top and folded button scollops or beaded button scollops may be produced in a similar way to that described in the lace boot ; but there will be a short length of loose fold, according to the width of the turn down, at the top between the edge of the button piece and leg on the inside. Assuming that the turn down was a quarter-of-an-inch at the top, when the fly lining was stitched to the lining, it should either stand above the top edge of the lining by a little more than the amount of the fold, or the stitching of the top edge of the outside to the lining to commence lower down. At any rate, the lining of the fly must be left loose at the top as far down the top-band as the outside has to be stitched. Assuming the top edge to be siitched along the boot, would then be turned over, and the fly on the outside fitted down on to the fly lining. The top edge may be stitched along to hold it, and the edges of the button pieces being stitched together, a row of open silking may be run right through the front seam ; this would hold the short length of loose fly lining at the top. The button holes may now be worked, boots buttoned, the stay put in and the boot finished.

Button flys may have the holes worked before being attached to the upper ; in which case the fly linings and the flys are first stitched together along the front edges, and the button holes worked. The front seam of the outsides are stitched to the outside fly. The linings being made, and the top edge of the outsides being stitched to the lining and down the outer edge, the lining is drawn underneath the fly linings, which naturally overlaps it. The whole of this part is stitched together by being open stitched or silked, this completing another method of closing button work. The vamping does not vary from that previously described.

The long boots illustrated on Plates 34 and 35, may be very simply closed by a machine, if they are correctly cut. If the boot is an unlined boot, with tongue and counter stitched through, the parts should first be carefully skived, particularly round the opening of the tongue and up the seams. The first operation would be stitching the side seams of the counter to the side seam of the front, then seam up the back of the leg on the overseaming machine, put it over a tree and beat the seam down flat—a sharp pull on the tree will pull the two edges so that they meet. The back

strap is next put on the leg, and seamed up both sides to within about a quarter-of-an-inch below the point where the back counter meets it ; fit the stiffener round the back of the heel, and then place the golosh and front over the boot ; the back part of the back counter going over the back strap—this should be skived down very neatly. This portion of the work is very similar to lasting on goloshes. The stitching may be done on a special long arm cylinder or post machine. It is advisable to stab the stiffener in by two rows of stitching, as described in the closing of the army Blucher ; the side linings are whipped in from the side edge of the back along the front.

The fronts of these boots should be carefully blocked and as carefully rounded. The back counter is also the better for a little blocking. If closed by this method, it is advisable that the counter should be a little short, to enable it to be strained into place before stitching.

If it is a lined boot, with a lining as Figure 1, Plate 35, the lining having first been blocked and the back edges having been skived the whole width of the allowance, as the dotted line CD, the lining of the front is placed on and stitched round from A to B on both sides. The outside leg is then put on the lining, and the whole of it fitted round a boot tree leg, the lining will then overlap on the inside according to how much has been allowed, and should be carefully pasted into place, or if necessary, held by a few fine tacks ; a row of stitching each side of the centre seam of the outside, at about a quarter-of-an-inch on each side of the edge, will seam the lining up on the inner side, and hold the outside firmly and flatly down to take the back strap. The back strap is now laid upon the outside and stitched right through, and the remainder of the boot finished as described before.

If the four rows of stitching down the back upon the inner side of the lining are objected to, the outside may be open seamed down, pushed out as described before, the lining carefully smoothed out so that the parts overlapping lay perfectly flat, and then stitched into place by the outside back strap.

Some butcher-fronted work is closed with the side of the outside counter over the front, by this method the front is first closed on, and the counter stitched on afterwards down to the bottom. An alternative method is to close up the leg, stitch on the back counter, and then place the front over the back counter and stitch right round. These differences are similar differences to those made in closing short boots, and represent similar degrees of quality. It is advisable that all the raw edges are set up with an edge-setter, so as to give a good finish to the boot.

The jockey top illustrated on Plate 33, although not difficult to close, requires a considerable amount of skill and care. First, buff the line at one inch from the top edge as C, down to about half the substance of the top, or a piece may be grooved out with a plough ; make a groove down the back seam so as to sink the stitches. Now seam the back up from E to F with the top outside in, rub the seam down thoroughly, turn it right side out, and beat it out flat on a boot-leg tree. Now cut a strap about one inch longer than the distance between E and D, measure carefully from D to E, and mark it on the strap ; make a little crease or fold in the strap about 1/8th-of-an-inch higher, as Plate 54 ; lay it on the back of the top so that the pleat or fold is exactly level to the line C, stitch it from about a quarter-of-an-inch below the line C, round the bottom and up the other side, fasten the other end of it in the same manner, keeping away from the fold. Cut another strap to form a side strap ; this may be cut to come to the edge of the top or to any distance above it, to suit the taste ; mark the distance from the line AB to the line C, as with the other strap, and make a fold in the same manner. This side strap may be stitched precisely the same as the back strap, or it may be stitched about

three-quarters-of-an-inch down, straight across, and up the other side, leaving the lower end of it loose. This is the orthodox method of leaving a strap in a gentleman's boot. A servant's boot will be stitched right down, round the bottom and up the other side, making a close stitched strap, distinguishimg it from the gentleman's top. The top edge A B is now pushed down into the inner side of the top, it is advisable to commence by pushing the two corners A and B, when they have been pressed down on the inner side, a sharp turn at the two other sides will generally turn the top whole down; as the top turns down it will take up the loose folds or pucker put in the straps; if the straps had not been left loose across the line where the top is turned, it could not be turned down. If it is a loose top, that is to say, if the top is made to be taken off to be cleaned, holes are punched at the front and back for the breeches loops to pass through; this holds the boot up to the breeches and the top on. If they are to be fast tops, the top edge A B is whipped to the top edge of the boot. Generally, the loose top is by far the best, it can be taken off to be cleaned, and also admits of the boot being cleaned more easily.

Some allowance should be made for the effect of different substances passing over each other, like the patent outside of a riding boot passing round the stiff lining. The illustration of the apparatus on Plate 57 may assist to explain this. The centre block represents the shape of the leg or block. Upon the right-hand side the different substances are shewn laid out on the flat, by this we see that the lower pieces are much longer than the top ones, this is to allow of them passing over the others when they have been bent round in the form of the leg; when the different lengths are bent round they come accurately together in the middle. The allowance made should be equal to three times the substance being turned round; that is, supposing that the lining was 1/8th-of-an-inch thick, it should be cut 3/8ths-of-an-inch larger, and the outside should be also cut that amount bigger, plus the amount for its own substance; as a rule, the outside is cut half-an-inch over the measure, if for a stiff leg boot.

The field boot (Plate 36) may be fitted by several methods; they have usually a short strap down the front, reaching to the top edge of the tongue, and a back strip covering the back seam, and generally leather lined. If fitted from the back, first seam the lining down the back and then the outside. It would be advisable that the outside be overstitched on the zig-zag machine, put over a tree, pull smartly, pulling the seam out flat, lay it on the lining, draw all surplus lining forward, and stitch it along the top edge and up the facing. Now pull the lining round to make sure that it will set quite clear, and seam it from the top down to the opening of the lace holes; next put in the tongues, and stitch them up from the corner of the facings to the top. The front strap is next placed on, stuck down and stitched through; it should not be necessary to seam up the leg at the front, but it may be whipped to hold it in place. You will now cut out the side gusset F E, and put on the side straps. The side seams of the vamps are next stitched through, it now remains to stitch across the vamp and to put the side stay or stud at the corner of the tab.

This boot may be fitted from the front, in which case the tongues might be first stitched to the vamps; the vamps stitched to the two sides of the legs separately; the tongues then stitched up the facings; the top seam in the lining and the outside stitched, and the front strap put on; this would leave the back seam and top edge to be completed; the top edge may first be stitched right round, and the back seam may be finished in precisely the same way as described for the riding boot.

In each of these classes of long work, one of the greatest points is to secure a clear lining, and it is therefore not advisable to make two lining seams, that is, to have the lining seamed up front and back before the leg is fitted round it. It is a far better plan to make the back seam of the lining with a lap seam, so that any excess of material may be smoothed away.

Plate 37 represents a Wellington boot, which may be closed in several distinct ways. If it is whole-fronted, the seams are made down the side; these are usually welted seams for heavy work and plain seams for light work. If made with a top lining, the top lining has its seam down the back as LK, and it is whipped to the leg of the boot across the line JK. If there is an outside counter, and the front is cut with a butcher tongue the side seam may be made as described for the riding boot, and the whole counter and front lasted on and stitched straight through.

With each of these boots it is advisable to put the stiffener into position before the counters are finally fitted, so that the exact amount required for them is secured; it is indeed the safer plan to secure the stiffeners in their place first, and then to stab the counters over them.

In each of these classes of work a very beautiful effect is produced by hand closing, which represents the art craft of the shoe-maker. In this case, the leg is cut out the precise shape of the tongue: the two edges are put together and hand stabbed; commonly, the remainder of the boot is closed by machine, but with this class of closing the fronts should be cut to have a slight curve at the point F (Figure 1, Plate 34), so that after the tongue is closed in by a flat seam, the line of stitching along the counter comes exactly to the corner of the seam, making one continuous line. The front, therefore, has to be cut very much in the shape as the line EFG; the point F being about 1/16th-of-an-inch above the line EF.

The legging on Plate 38 is nearly as much a question of blocking as of closing. Seeing that the whole of the leg requires blocking, and that simply blocking of the back edge is not sufficient, the front edge of the legging, *i.e.*, the two raw edges in the roughed out caster, should first be seamed up on the over-seaming machine. The legging is now placed over the block and blocked out; this is a rather better system than tacking the front seam or depending upon clenches. The blocking having been finished, the gussets should next be seamed up; they are preferably flat seams. If not, a plain seam will do, but it must be carefully rubbed down. The whole legging is then cut precisely to shape, or it may be rounded before seaming. The fittings are now seamed together, the facings to the counters along the dotted line JK, Plate 38. If it is a buttoned legging, the buttons may be sewn before the facings are put on, or they may be attached afterwards. If it is a spring-fronted legging, the springs and fasteners must now be put in. If it is a puttee legging with straps, the facings and counters have simply to be stitched through. In any case, the fittings are now stitched and the straps attached. If it is a long strap puttee, the short loose straps should be put up the back first, and the long strap should be inserted between the facing and the outside before stitching. The short strap at the top is usually put on last.

It is an advantage to bind the top edge of these leggings; this would be done before the facings were put on, and if done on the round, helps to hold the top edge in shape. If there is no binding the edges should certainly be set up.

These descriptions are an account of the simple processes connected with practical closing. Each item mentioned would represent a distinct process by a special operative in the closing room of

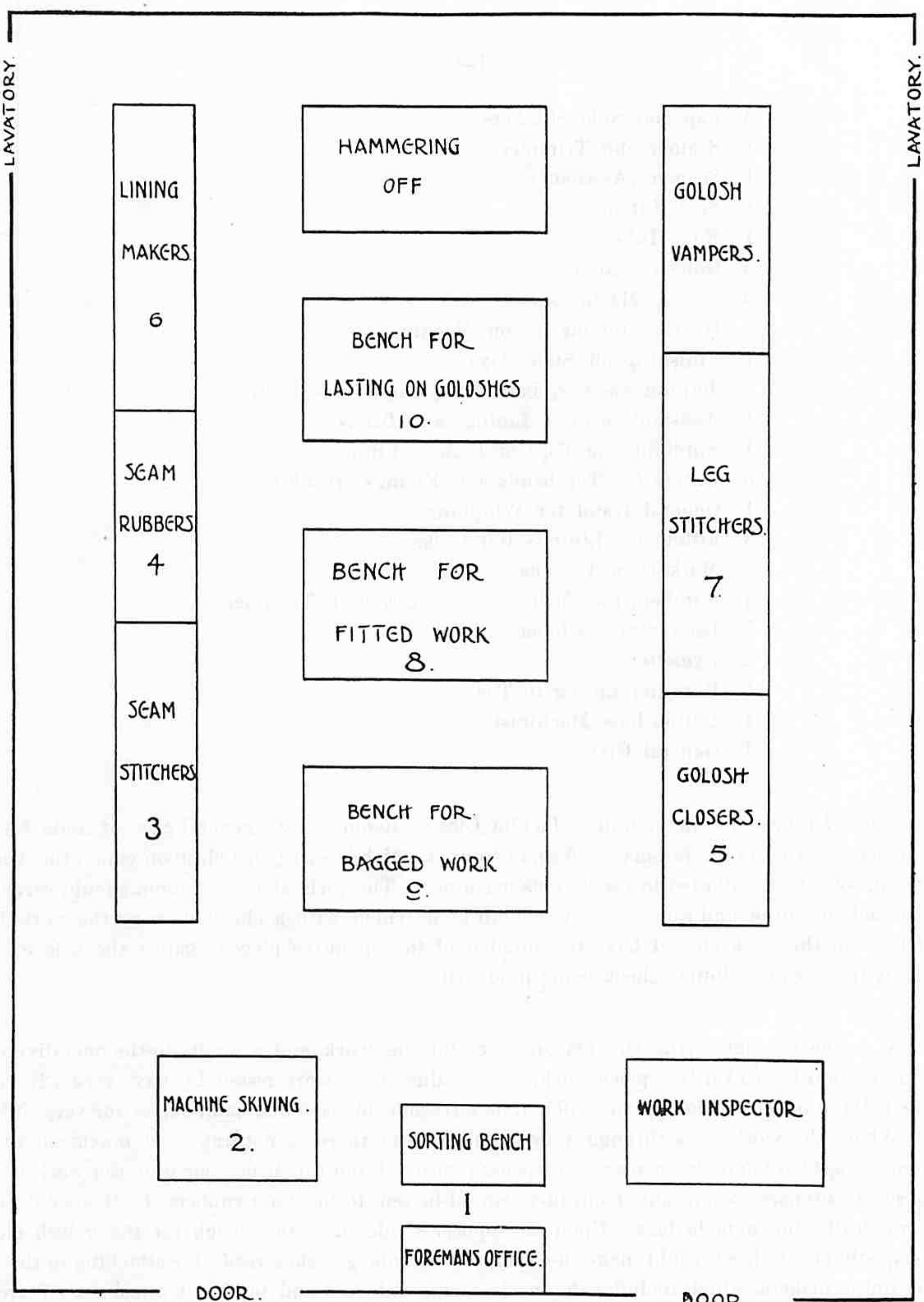
a modern factory. The orderly arrangements of these operatives, so that the work passes naturally and in its correct order throughout the department, represents the modern method of systematized manufacture.

Naturally the extent of the variety of the work, and the system of closing generally used, affects the actual order in which these operatives are arranged ; but as a general principle the work would be started near the foreman's office, a large bench or table being reserved for sorting out the stuff. Upon one side of the bench the parts to be skived would be passed to the machine skivers and on to the the machine folders. In the arrangements shewn in the plan, the skiving machines and folding machines are placed on the left-hand side of the foreman. The skived work would then be passed to the different benches ; the inside facings and top-bands towards the lining makers' machines and on to the facing and top-band stitchers. The legs would go to the seamers and then to the folders or beaders. These two processes being complete, the stitched linings and the stitched legs should reach one point together. If they are to be fitted, a fitting bench should be arranged at this point so that the block fitting can take place without delay. If they are to be stitched and turned, the top stitchers' machine would come next. In either case the top without the goloshes or vamps would be completed in this section.

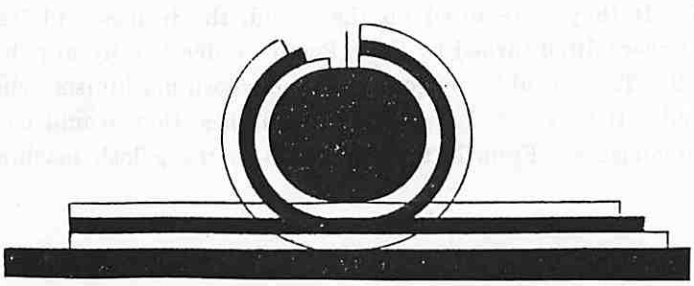
Upon the opposite side of the room, the toe-cap punches, pinking machines, skivers for goloshes, and any folders that might commonly be used for vamps are arranged in their order ; toe joiners, toe-cap stitching machines and side seamers would follow. Along this bench the vamps or goloshes would be prepared to meet the legs and linings. These legs having either been held together or lasted, would meet the goloshes at a fitter's bench, where the goloshes would be lasted on. Or in the case of the holding-on system, would meet the closers, who would stitch the vamps. From this point the inspector would take the uppers, go carefully through them and pass the work ; generally there is one person selected to pass the work, and two or more assistants act as superintendents to see that no one is waiting about in the room. In a shop turning out about 3,000 per week, the following staff would be required :—

1	Chief Superintendent
1	Assistant Superintendent
1	Work Examiner
2	Special Fitters
1	Special Machinist
4	Girls as Knot Tiers
1	Girl, to open work and mark whatever is required
2	Machine Skivers
1	Leg Seamer
2	Seam Rubbers
1	Binding Turner
1	Solutioning Girl
2	Beaders (Machine)
1	Hand Beader
1	Punching Girl
2	Girls to stick Caps to Toejoiners
1	Girl to whip Overseam Toejoiners

Plate 57.



Plan of Machine Closing Room.



Effect of Substance.

3 Cap and Side Stitchers
1 Seamer and Trimmer
1 Seamer (Assistant)
1 Side Stitcher
1 Edge Inker
3 Golosh Fitters
5 ,, Machinists
1 On the Hammering-off Machine
1 Finishing off Side Stays
1 Joining Facings, Back Straps and Back Leathers
1 Assistant to close Linings and Backs
1 Stitching the Tops of Legs to Linings
3 Fitters for Top-bands and Facings (Inside)
1 General Hand for Whipping
3 Fitters for Linings and Backs
1 Marker for Facings
4 Stitchers for Facings and Edges, with Trimmer
1 Back Strap Stitcher
1 Eyeletter
1 Running Lining to Toe
1 Button-hole Machinist
1 General Girl

Plate 57 represents the plan of a Machine Closing Room doing a general class of trade for the British market. No. 1 is the foreman's office, in front of which is a large bench upon which the work is opened out, sorted, and allotted to the various machines. The girls about the room should carry this work to each machine, and each operative should be provided with a check shewing the work done. The tickets on the work should have the number of the operative placed against the side of each process, by this means a double check being produced.

A means of identifying the person who did the work and a credit to the operative upon which they could be paid if it is piece work, or the value of the work tested by day work (2) is the machine skiving bench, at the end of which it is advisable to have one hand skiver for very difficult work. Where the work goes through very regularly and there is nothing very much out of the common, the special hand skiver may be dispensed with. From this bench some of the work will go to the seam stitchers, No. 3, and from there would be sent to the seam rubbers, 4; this would complete practically the outside legs. Upon the opposite side 5, is the bench for the golosh closers or toe-cap stitchers; these would make the vamps or whole goloshes ready for attaching to the legs. 6 is the lining makers, which includes the inside facing stitchers and top-band attachers. 7 are the stitchers, who seam the legs to the linings. By the holding-on system, the linings and legs would come straight to No. 7. If they were fitted on the round, the linings and legs would be passed to bench No. 8. If they were fitted turned by the "Booth Beader" or by any bagged method, they would go to bench No. 9. They would now go over to the golosh machinists, who would hold on the goloshes and stitch round. If they were to be lasted on goloshes, they would be passed from 7 to 10, the bench for lasting on goloshes. From 10 they would go to the golosh machinists. If they were

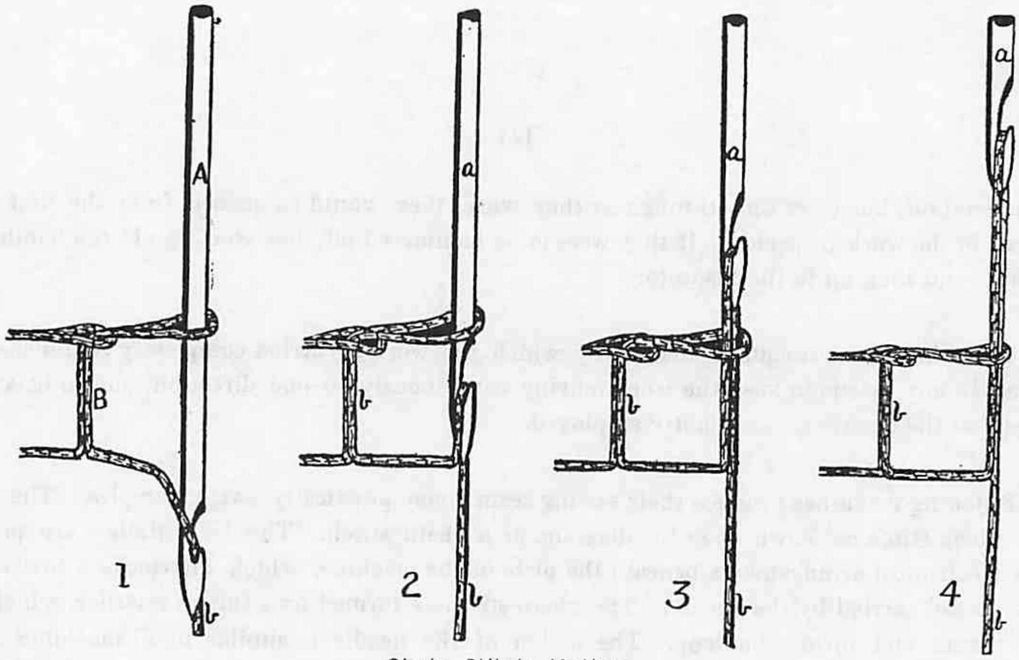
not hammered off, but were sent through as they were, they would be passed from the first golosh machinists to the work inspector. If they were to be hammered off, they would go to the hammering-off machine and then on to the inspector.

This simply represents a method by which the work is carried completely round the room. The object in any case is to keep the work moving continuously in one direction, and so balance the processes that the closers are constantly employed.

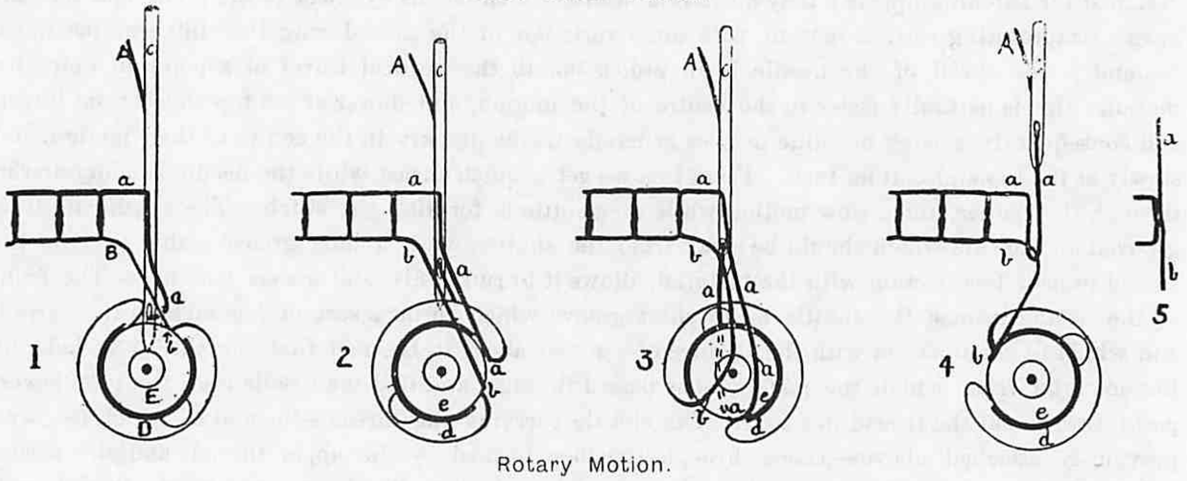
Stitching machines produce their sewing seam upon practically two principles. They either produce a lock-stitch as shewn upon the diagram, or a chain stitch. The lock-stitches are produced by some mechanical arrangements beneath the plate of the machine, which interlocks a lower thread with the thread carried by the needle. The chain-stitch is formed by a thread retarder, which holds the top thread and forms the loop. The action of the needle is similar in all machines that are designed for stitching uppers; they all have a needle which has its eye near to the point, and they all have a reciprocating vertical motion, with some variation in the pace during the different positions. Generally, the speed of the needle is in proportion to the vertical travel of a point on a circular motion; this is naturally faster in the centre of the motion, and slower at the top and bottom travel, and consequently, sewing machine needles generally travel quickly in the centre of their motion, and slowly at the top and bottom turn. From this we get a quick thrust while the needle is being driven through the leather, and a slow motion while the shuttle is forming the stitch. The needle itself is grooved on the side which should be away from the shuttle, with a long groove; this permits the thread to have less friction with the material, allows it to run easily, and assists take-up. The front of the needle nearest the shuttle has a short groove which forms a sort of looseness in the thread, and which in combination with the absence of a groove above it, the fact that the thread is held by the material from which the material has passed through, and that the needle rises from the lowest point, throws out the thread in a loop. The shuttle carrying the thread—the end of which has been previously attached above—passes through the loop formed by the upper thread, and the needle rises and draws its loop upwards into the material, and naturally draws the shuttle thread with it, forming two interloop threads in the material; this is briefly, the action of the lock-stitch machine.

The method by which the shuttle acts varies between the machines. The original boot machine shuttle was what is generally called the "weaver" form, that is, it is a narrow boat-shaped shuttle, which carried the thread reeled round a wire called a bobbin; it reciprocated along a race in such a manner that the body of the shuttle passed into the loop thrown out by the needle, and was carried quite through it at each stitch immediately the needle rose; the shuttle having stopped was returned to its original position, and the motion repeated. There was consequently a stop at each end of the stroke, and a consequent vibration and loss of pace; it however made a very good stitch, but was too slow for modern requirements.

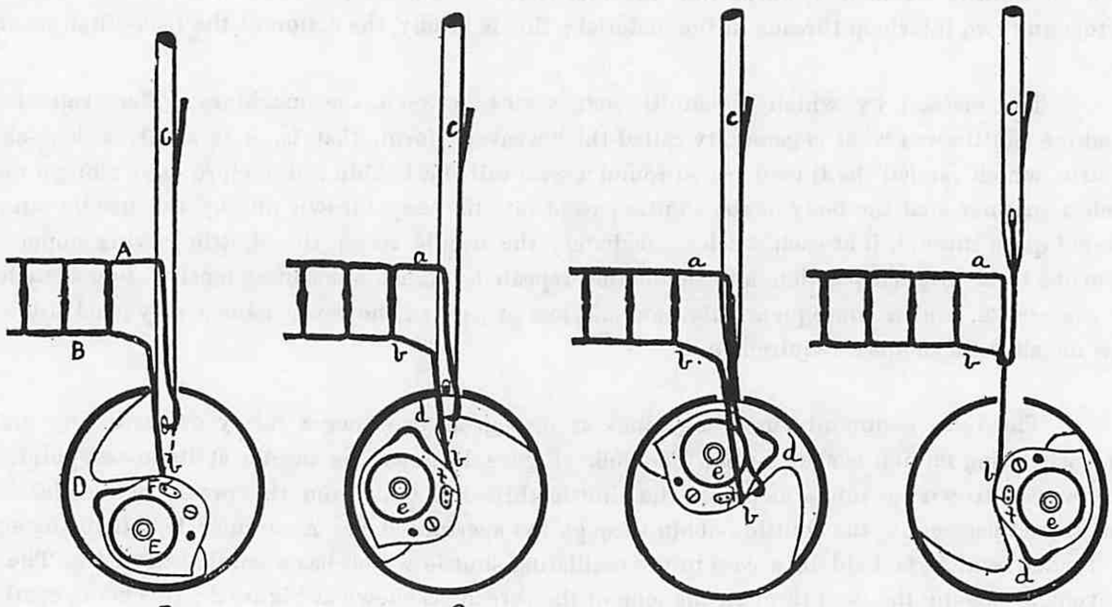
The most commonly used machines at present have either a rotary or oscillating motion. The oscillating motion is shewn upon Plate 56. Figure 1 shews the needle at its lowest point, with the thread thrown out into a loop, and the shuttle thread B taut from the previously made stitch; this thread passes into the shuttle bobbin through the aperture at F. A circular bobbin being shewn at E, and which is held in a case in the oscillating shuttle which has a pointed nose, D. The next movement passing the nose through the loop of the thread, as shewn at Figure 2; this being continued



Chain Stitch Motion.



Rotary Motion.

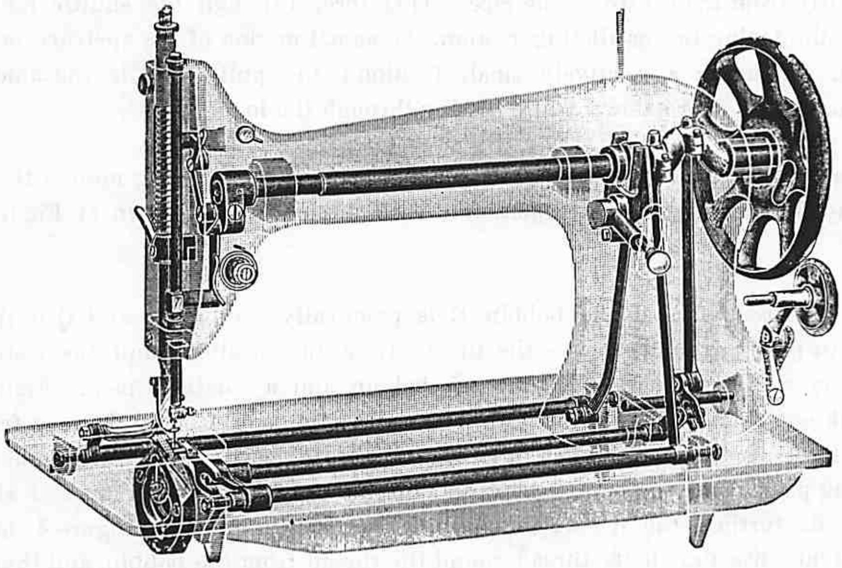


Oscillating Shuttle.

Different Kinds of Stitching Motions.

To face Page 125.

Plate 57a.



Machine showing Interior Mechanism.

Machine No. 31K15 ... With Singer Driving Attachment.

" " 31K18 ... Fitted with Wheel Feed for Leather.

until the shuttle bobbin passes into the loop, as Figure 3 ; in the meantime the needle rising slowly. Figure 4 shews the shuttle through the loop, the needle, having lifted quickly, has drawn the top thread over the heel of the shuttle, with the shuttle thread interlocked, as shewn. A further rising of the needle draws the stitch into the centre of the material. It will be noticed that although the oscillating shuttle moves round about 200 degrees of the circle of the race, the bobbin hole F moves very slightly from the centre of the race. Therefore, although the shuttle moves constantly round and back, producing the oscillating motion, the actual motion of the aperture is not more than 1/8th-of-an-inch, producing a relatively small friction ; the pull-down is the amount of needle thread which the shuttle draws down while passing through the loop.

The rotary motion is a similar motion, except that the interlocking nose of the shuttle passes completely round the race during the formation of each stitch ; this is shewn at Figures 1, 2, 3, 4.—Rotary Motion.

It will be observed that the bobbin E is practically stationary, and that the hook in the circular motion in passing round, carries the thread from the needle round the stationary bobbin. This could be very well described as a stationary bobbin and a rotating hook. Figure 1 shews the point of the hook entering the loop thrown by the needle ; the loop A being the loop from the needle, and the point B being the point where the shuttle thread leaves the shuttle bobbin. The hook (Figure 2) having passed into the loop, draws the loop round the bobbin. Figure 3 shews the loop carried round still further, the needle now having commenced to rise. Figure 4 shews the needle having lifted higher has drawn its thread round the thread from the bobbin, and thus produced the stitch. The complete stitch is shewn at Figure 5. In some machines, the bobbin has a rotary motion with the hook ; this is rather common in some machines used in sewing the bottoms of boots. In upper stitching machinery, the bobbin is usually stationary, and the whole of the interlooping is done by the rotating hook.

The chain stitch is produced by a single thread instead of a double thread motion, but the action of the needle is very simiiar to the action of the lock-stitch machine. The needle descends and throws out a loop ; this loop is seized by a looper which holds it and expands it, while the needle rises into the material. The needle again descends and forms another loop, which is thrown inside the previous loop made by the needle, and expanded by the looper. The looper now seizes the second loop and holds it, while the needle rises with its thread interlooped with the first loop made. Upon it again descending the action is repeated, forming a straight row of stitches on the top side, and a series of interlocked loops on the other side. If the last loop made is carefully fastened down, this forms a solid seam, but if not, the whole seam can be drawn out from the end.

The appearance of the stitches is greatly effected by the manner in which the thread is drawn or held by springs or grooves in the shuttles and above the needle. These "tensions" or frictions hold the thread and so make a tight seam. If the tension is unequal, the side which is the loosest is naturally drawn towards the other side. The consequence is that extra tension on the top or needle thread pulls the shuttle thread up above the line of stitching.

The amount of "take-up" is also very important and has direct connection with the amount of thread pulled down by the shuttle. This pull-down is decided by the size of the shuttle or interlocking device under the machine ; and it also decides the amount of friction the thread is

subjected to before it is deposited in the work. If we assume that the loose thread—including that which the shuttle draws down when it passes through the needle loop—to be two inches, the whole of this, less the amount taken by the stitch, would have to be drawn up by the take-up as the stitch was made ; this is again drawn down on the making of the next stitch, the amount required for the stitch being drawn from the needle thread. Therefore, the thread passes through the eye of the needle twice each time a stitch is made : one during the pull-down by the shuttle and again by the pull-up by the "take-up." Seeing that only about an eighth-of-an-inch is used at each stitch, this means that the thread passes through the eye of the needle about thirty-two times before being interlocked in the work. From this we see how important it must be to use a thread that will withstand friction, and to have needles that are smooth in the eye. The tensions and take-up are shewn on Plate 58.

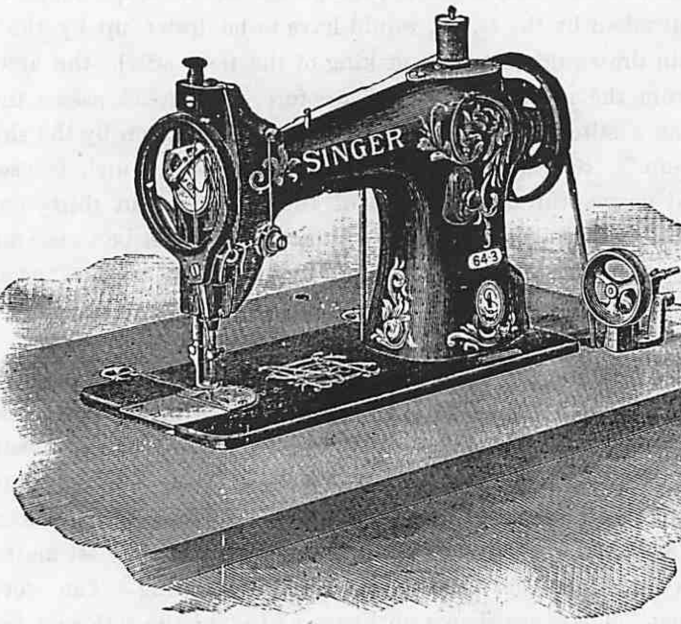
The different kinds of take-up are termed negative if they draw by a spring action, and positive if they pull a certain amount by a lever. The negative draws all loose thread, the positive pulls back all except that required for the stitch ; both of these work in connection with tensions that modify their action. The method of moving the material between the stitches is by holding it between a top foot and a bottom wheel which has its surface serrated, this is called a wheel feed ; it pushes the material forward between each stitch and is probably the best method for hard materials. This is fitted on most machines that are used for general stitching. The work is held down to the feed by a roller or a foot. These are shewn on Plates 57 to 59 ; the roller on 44-10 machine, the foot on the 31-K 15. The drop or four motion feed consists of a serrated plate which holds the work to a presser foot and lifts it forward between the stitches, the plate then drops to a lower level, and out of contact with the work, and goes back, lifts again, and again carries the work forward. This motion is the best for all light materials, or where there is much movement in the work during stitching. This motion is fitted to the 44-10 and 18-16 machines.

All upper stitching machinery is driven from the main shaft to a driving wheel on the machine. In lock-stitch machines this driving wheel is usually connected to the end of the needle shaft, and by link or lever motion to the stitch-forming apparatus beneath the bed of the machine.

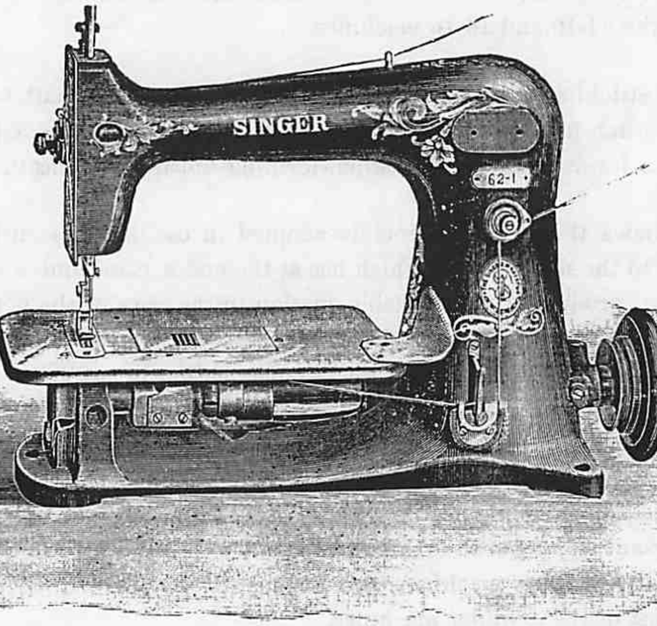
Plate 57 shews the general principle adopted in oscillating shuttle machines. The driving wheel is connected to the needle shaft which has at the end a cam, and a connecting link between it and the needle bar, producing the variable motion in the pace of the needle, previously described. Near the driving wheel is a crank, which is connected by a lever to a link motion beneath the bed of the machine ; this link motion converts the circular motion in the crank to an oscillating motion in the shuttle shaft. This oscillating motion, as shewn upon the separate diagram, is confined to about 200 degrees of the circular race, and travels backwards and forwards in that distance. The presser foot or wheel is driven towards the material by a spring. When the machine is fitted with a step feed, this is also acted upon by the needle shaft. The oscillating motion may be considered to have been the first important step from the reciprocating action or weaver form of shuttle ; it is represented in a high form in the "Singer" machines, and is generally applied to the ordinary leather stitching machines and to most of the cylinder machines.

Rotary motions have been used by a great many Machine Companies, as indeed are most of the motions now in use. In fact the actual motions—rotary, oscillating, reciprocating, and looper—are in machines made by the Singer Machinery Co., The Wheeler and Wilson Machinery Co.,

Plate 58.



Machine No. 64-3 ... Rotative Hook.



Machine No. 62-1 .. One Needle, one Looper.

The Jones' Machinery Co., and several other machinery producers, who make a speciality of upper stitching machines. Chain-stitch machines are also produced by a great many upper stitching machine manufacturers. The Union Special Machine Co.—an American Company—has made a speciality of this machine for several years, and machines of this type are to be found in most American Shoe factories.

There however appears to be some prejudice amongst British manufacturers against chain-stitch machines, but there can be no doubt that they are much faster than ordinary lock-stitch machines, and that for some work they are practically as good, particularly where the end of the seam is naturally held down by some other row of stitching. The "Singer," No. 62·1, is a machine of this kind; it forms a double thread chain-stitch, with one needle and one looper; the thread is taken straight off the reel, so that there is no feeding of bobbins or stopping of the machine during stitching. It is a particularly good machine for closing up linings, with a nominal speed of about 3,000 stitches per minute. The companion machine to this (No. 244) makes a similar stitch, but has two needles which gauge out from 1/16th apart to 5/8ths, and will make stitches from eight to thirty to the inch. This is a valuable machine for running down the webbing at the backs of ladies' boots, being fitted with a special webbing attachment for that purpose. It will also open stitch or silk the sides of the seam made with the 6·21 or single needle machine. A similar machine to this, making a double-thread chain-stitch, and also for staying and webbing, is the 62·13 machine; this has two needles and two loopers, and will stitch two rows of stitching at once.

Where there is some objection to the chain-stitch, an exceedingly fast machine for linings, and which makes a lock-stitch as well, is the 64·3 "Singer"; this is a rotating hook machine, with a drop feed and stationary bobbin case; the bobbin contains an extra long length of thread: the hook makes one revolution per stitch, and the arm of the machine being long, leaves plenty of room for the work to pass underneath. It is a particularly good machine for linings where a lock-stitch is preferred. If it is desired to run the lining up after seaming with a row each side, or silking, and there is some prejudice in favour of the lock-stitch machine, this can be done on the 31·55 machine, which has two needles and two shuttles, and which can be gauged out from 1/16th to a quarter-of-an-inch.

For general machine stitching, plain seaming, and the ordinary light stitching, the 31·18 is very suitable. It has a wheel feed with a nominal maximum speed of 2,000 stitches, and is an exceedingly good machine for general stitching. The machines mentioned are shewn on Plates 57 and 58. For stitching the outsides to linings and trimming at the same time, the "Lock-stitch" 44·7 machine is suitable; this has a drop feed and an adjustable leather trimming attachment. The lower end of the needle bar carries a knife, which has an elongation that passes through an opening in the throat plate at the back of the needle; this piece is held by a spring slide pressing it against the cutting bar, steadying and keeping the knife exactly parallel with the lining stitches. The knife can be adjusted to cut at any distance from the lining stitches, so that the trimmed edge can be close to the stitch or at some little distance away.

Where the trimming arrangement makes it necessary to trim underneath the material, the 44·15 "Singer," fitted with horizontal under trimming attachment, is suitable; the knife is set to trim under the edges at the same time as the stitching is being done, and will go round any sharp corners or curves, as button pieces, or the top edges of scolloped lace boots; it is also fitted with a bead guide, which will feed the loose bead into the edge at the same time as it is being trimmed.

The Union Special Machine Company, which makes a specialty of high speed machines for finishing, [illegible] and [illegible] to a great many upper [illegible] [illegible]. The [illegible] Mouton [illegible] Company — another [illegible] of [illegible] for [illegible] [illegible] this type are to be found in most [illegible] shoe factories.

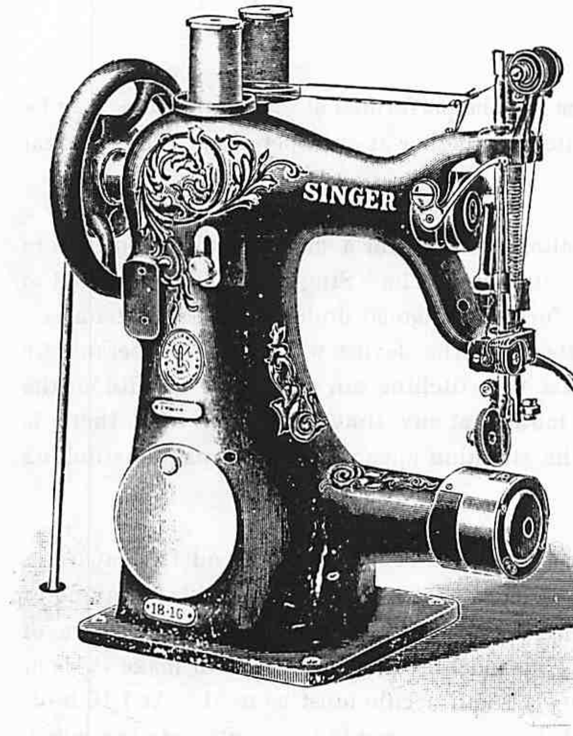
[illegible] machines [illegible] in the same [illegible] [illegible] [illegible] stitch [illegible] they are [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. The [illegible] No. [illegible] with a [illegible] speed [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] (No. [illegible]) [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] and will make [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. It will [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] machine. A [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] machine [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

[illegible] [illegible] [illegible] [illegible] [illegible] to the chain stitch [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] Singer [illegible].

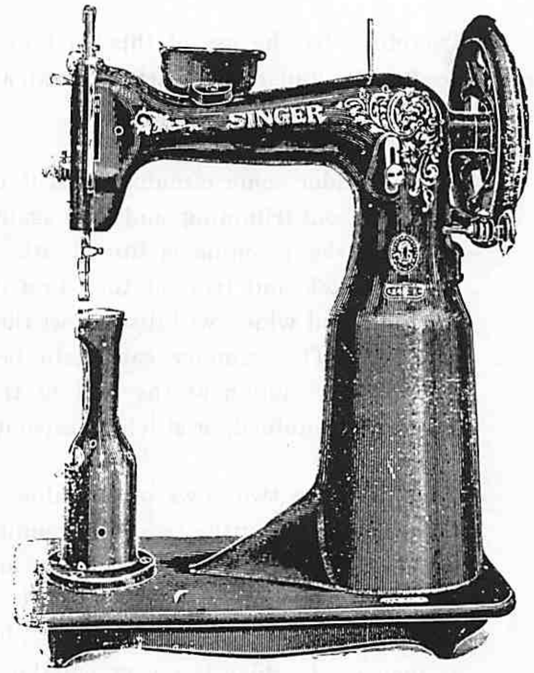
For [illegible] [illegible] [illegible], [illegible] [illegible] and the [illegible].

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible].

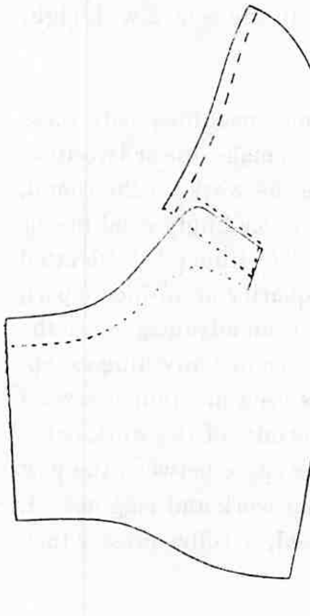
Plate 59.



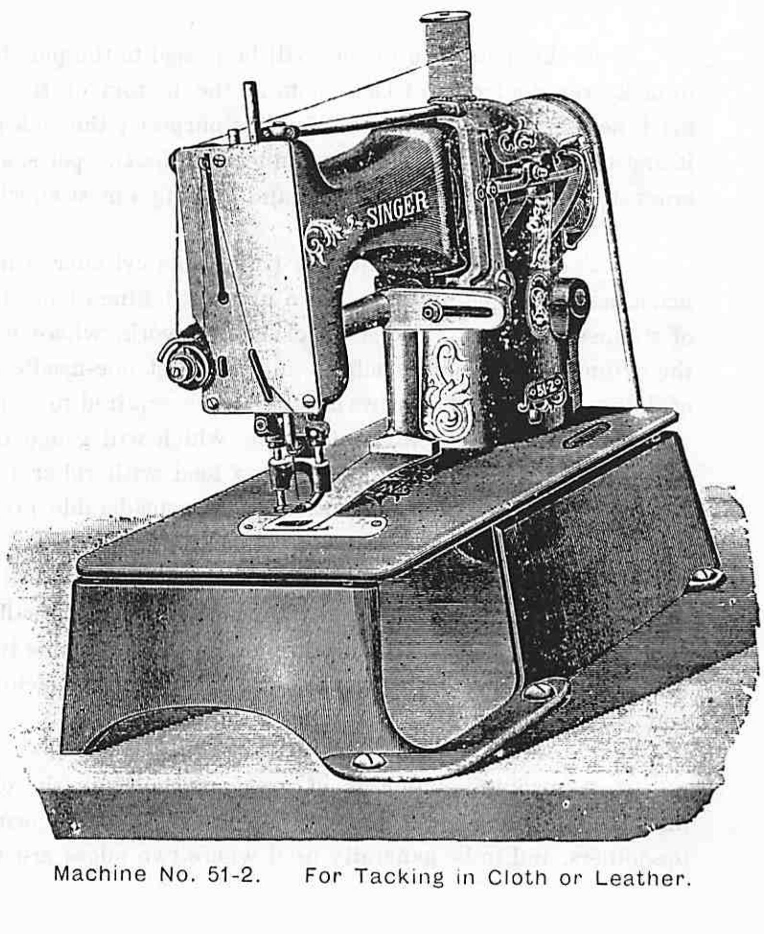
Machine No. 18-16 : Two Shuttles.
Short Arm—for High Speed in Vamping Shoes, etc.



Post Machine for Vamping.



Straight cut Tongue. Open Tap Derby.



Machine No. 51-2. For Tacking in Cloth or Leather.

Sewing Machinery by
THE SINGER MACHINE Co.,
Chiswell Street, LONDON.

Therefore, by the use of this machine, three operations may be performed at once ; the edge may be beaded, the underneath part trimmed, and the whole stitched together at one operation. The nominal speed is 1,600 stitches per minute.

Under some circumstances it is necessary to stitch and trim for a short distance, and then to stitch without trimming, and then again trim with the stitching. The "Singer" 44·26 is designed to do this; the machine is fitted with a knife, which forms a diagonal under edge leather trimmer. It will stitch and trim at the same time ; but is fitted with the device which can be operated by the knee, and which will disconnect the knife bar, so that the stitching can be carried on without the trimmer. The trimmer can again be brought into motion at any time, and therefore, there is an alternate motion at the will of the operator of the stitching apparatus, trimming and stitching apparatus combined, or stitching separately.

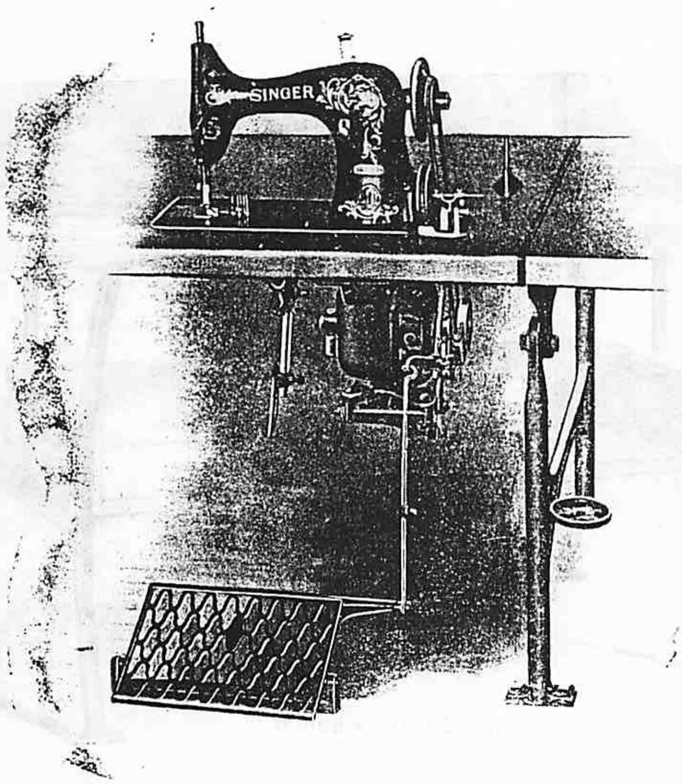
Where two rows of stitching are required at any distance between 1/16th and 1/4th apart, as for vamping or putting two rows round the top edge of the lace boot or for open stitching, staying or silking, the "Singer" 31·55 is very suitable ; but some care should be taken in the selection of the needle where the distance apart is very small. The machine is constructed to make rows of stitches from 1/32nd-of-an-inch apart, but at this distance a small needle must be used. At 1/16th-of-an-inch apart, which is a very suitable and practical distance, the machine is quite safe ; a much larger needle can be used, and the two rows of stitches going round the parts at the highest speed this machine runs at, forms a very economical method of stitching edges.

At this point the uppers will be passed to the punchers and eyeletters, and it will be advisable to tack over the fronts of lace boots at the bottom of the facing rows. The "Singer" tacking over machine makes a stitch suitable for this purpose ; the tack may be made up to 3/8ths-of-an-inch wide ; it first makes eight long stitches connecting the two parts, and then ties these in the centre with eight cross stitches, completing the tack and making a most effective stay.

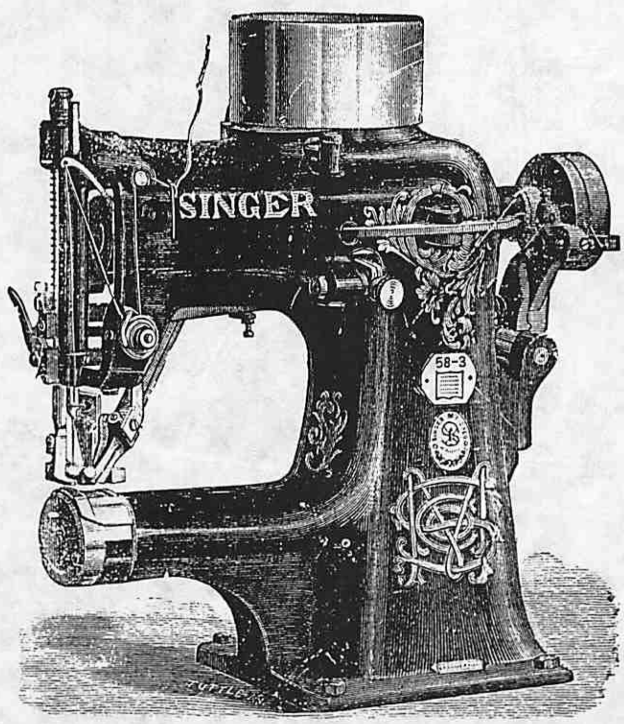
The work would now be passed to a cylinder arm machine or to a post machine ; both these machines should be in any modern upper stitching room ; they are each made to make one or two rows of stitches at a time. For some classes of work, where it is desired to close the work on the round, the cylinder one-needle machine and the post one-needle machine, are both exceedingly good means of doing it. Where two rows of stitches are required to be put in together, the "Cylinder" 18·16, fitted with two shuttles and two needles, and which will gauge from 1/16th to a quarter-of-an-inch apart, will produce good work ; this is a drop feed with roller presser foot, which is an advantage over the ordinary motion ; but at present, there is considerable prejudice in England against anything except a wheel feed, and in some cases, a roller presser foot. The post machine has been mentioned several times, there can be no doubt that it is the most useful innovation ; it permits of the work being turned about in almost any direction, and when made sufficiently long in the space between the post and the upright body of the machine, it is most valuable in the closing of long work and leggings ; it is made to do very similar work to the cylinder arm machine, has a drop feed, a roller presser foot, and can be run up to 1,500 stitches per minute.

A machine which is of great assistance in the closing room, is the over-seaming or zig-zag machine, which is used to whip up backs, put the ornamental stitching on top-bands, seam on toe-joiners, and to be generally used where two edges are to be whipped together. The list number

Plate 60.



Power Bench.

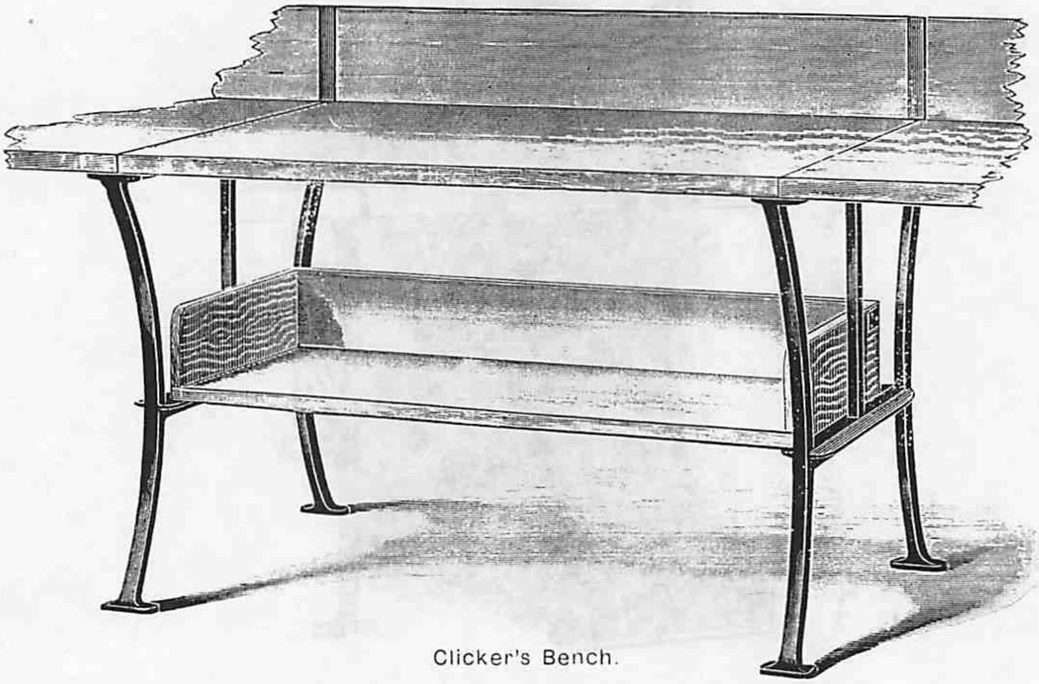


Button Sewing Machine.

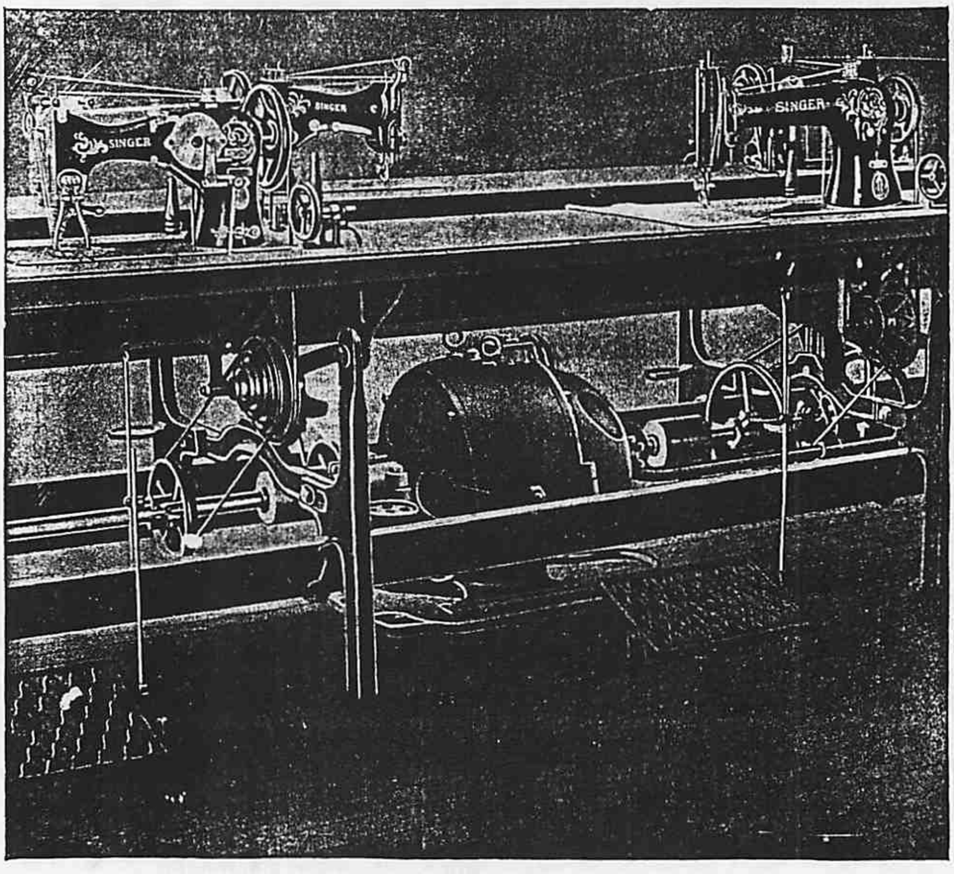
Upper Stitching Machinery.

By The SINGER MACHINE Co.,

Chiswell Street, LONDON.



Clicker's Bench.



Fitted Electric Motor.

for this machine is 32·52. The button-hole machine, with cutting attachment and automatic stops, will work a button-hole half-an-inch to $1\frac{1}{2}$ inches long; it has a speeial cutting attachment and automatic stop. The work is put face down under a clamping device which secures the work during the operation of the machine. The feed carries this clamp so that the different parts of the hole come precisely under the needle, and at the required speed of the stitch-making mechanism. The apparatus for making the stitch consists of loopers and spreaders under the work plate and the needle. The threads from the upper and lower spools are locked together and form a hard pearl stitch, a strengthening cord or gimp is laid along the edge of the button-hole and covered by the thread forming the stitch.

The "Reece button-hole machine," which is probably the oldest and most popular button-hole-making machine known, clamps the stock, cuts the hole, starts stitching, follows the edge of the button-hole all round from end to end, stops and unclamps the button piece automatically, and runs at the rate of about ten holes per minute. The ends of the button-holes may be finished on a barring machine or on the "Reece" finisher. The "Singer" barring machine is the companion machine to the button-hole machine; it places the bar across the end of the hole and generally finishes the work of the button-hole machine. The "Reece" barring and finishing machine puts several stitches across the bottom of the holes; the finisher collects the loose ends and staying threads, and fells them down neatly to the button fly without the stitches going through.

Another most useful machine is the button-sewing machine; this puts four fastening stitches in the button shank and twelve stitches through the loop; its maximum pace is 1,200 stitches per minute, at which rate its capacity is 4,000 buttons per hour: each of these buttons is sewn on separately, there being no stitches between the buttons. The buttons are fed from a hopper or cup situated in the arm of the machine, much the same as a self-feeding eyeletting machine; they are automatically fed down a chute one at a time, in the correct position to be acted on by the machine. Upon reaching the level of the material, the part to be sewn is pushed up and the needle forms its stitches with a lock-stitch, therefore the removal of any one button from the shoe does not affect the fastening of the others.

These represent the usual machines commonly found in a closing room; the number of each kind would depend upon the capacity of the room. The arrangement required for an output of about 5,000 will be found on the plan of the room—Plate 62. Where fitters are used, it is advisable either to have square fitters' benches made wide enough to take work in the centre and to admit of the girls sitting round, or they may be provided with benches similar to the bench shewn on Plate 61. The stitching machines are usually arranged on special benches, which may be in single or double rows. The double row bench is shewn at Figure 2, Plate 61; this bench, with a clear space between each closer or stitcher, has a well between the two lines of benches to take work. The automatic driving arrangement is connected to the main shaft running underneath the bench. The illustration represents a method of driving each machine or group of machines by a separate electric motor, by this means the machine may be started or stopped wiihout interfering with any others, and the wastage of driving the whole of the main shaft for one machine is prevented; these separately electric-driven machines are becoming very common in other trades and may eventually be adopted in the shoe trade.

Sewing threads are made from silk, cotton, and linen, in different thicknesses which are defined by numbers, the higher numbers represent the smaller threads. The numbers generally used

in shoe stitching are from No. 12 to 30 silk, 20 to 60 cotton, and 60 to 80 linen. The size or number is selected according to the class of work and the amount allowed for the cost of stitching. For general stitching, either silk or cotton is usually preferred, linen threads are too stiff and coarse for good stitching on light work.

There is considerable difference of opinion as to the relative value of silk and cotton as stitching threads ; much of this difference may be ascribed to the varying quality in silk threads, and to the practically constant quality in cotton.

Silk threads for boot stitching is referred to as twist. This, in its best form, consists of nine strands twisted up by four motions into one thread. The first operation consists of unwinding the strands from the cocoon made by the silkworm ; during this operation the strands are often broken and short lengths are flossed off, and are referred to as floss and were at one time regarded as waste. The long strands are twisted up into threads, having three strands in each thread, three of these are twisted up into the thread sold for stitching, and referred to as silk twist. If this twist is unwound it will be found to divide into three, each of these will also unwind into three long strands as wound from the cocoon. This represents the highest quality twist, and if unweighted, is the finest stitching material known.

But a large quantity of silk thread is sold as twist which is made from the short lengths broken off in making best twist. These short lengths are spun up into strands and twisted up in a similar manner to the best twist, but as they consist of short lengths, do not resist the friction of the machine, or of the wear, so well as real twist. This lower quality of silk thread is termed "spun silk" twist ; it varies in strength in proportion to the length of the pieces used.

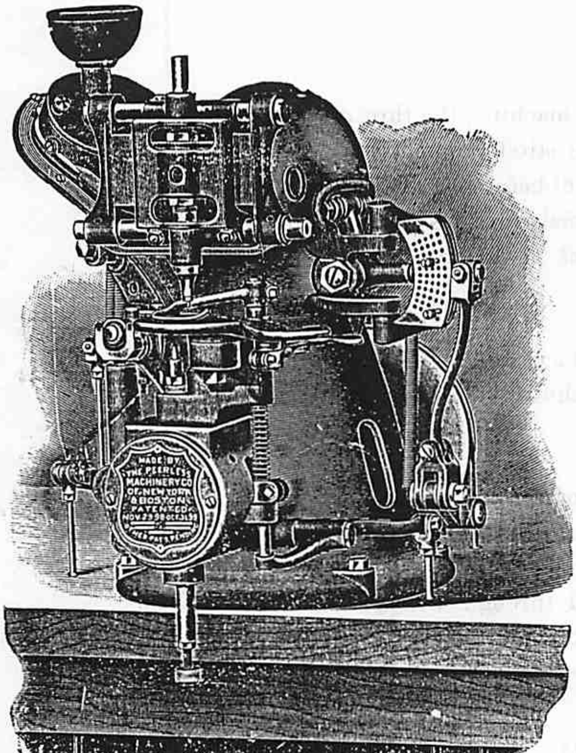
Silk, like all other supplies sold by weight, often has weight added to it that is no advantage to the user. This added weight may be made by immersing it in baths of tannic acid, and by the use of heavily loaded dyes. Some portion of this added weight cannot be prevented, the tannic acid serves a useful purpose if not carried to excess, and all dyes have some weight. But in some cases dyes are used that contain large quantities of metals, these are termed loaded (or weighted) dyes, and no silk should be bought that contains them. There must be some added matter to silk, the best twists contain about nine per cent. of raw silk, common silks about seven per cent., therefore, the buyer of ten pounds of bad silk pays for three pounds of added weight.

In addition to this, there are a great many artificial silks, which are difficult to detect from mere inspection. A simple method is to burn the thread by holding it up and setting fire to the lower end, if it burns steadily up from bottom to top, it is not all or nearly all, silk. If it is pure good silk, it will not burn more than a few inches at the time, it will smell like burnt feathers and will form little lumps in burning, and go out. Some good silks are dyed with inflammable dyes, these flare up in burning more than some others, but they will not burn more than a few inches at the time. All other threads, linen, cotton, and mixtures, burn from bottom to the top.

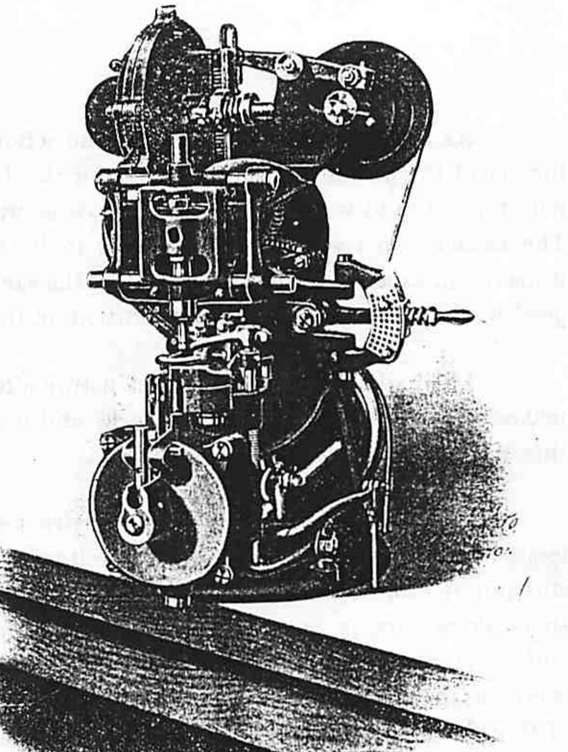
This variation in the quality of silk thread has caused some opinion that cotton and linen are better stitching materials than silk ; this is not correct as regards best silk twist, but it does apply to the commoner spun silk thread.

To face Page 130.

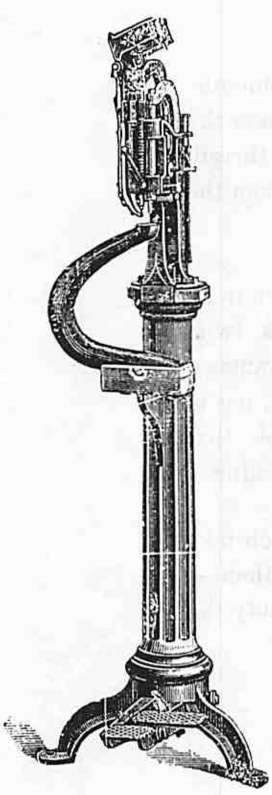
Plate 62.



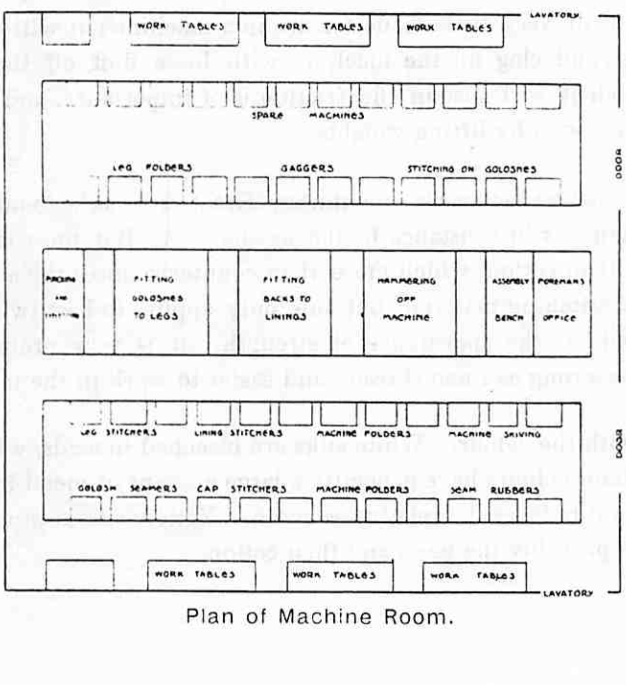
Rapid Eyeletter.



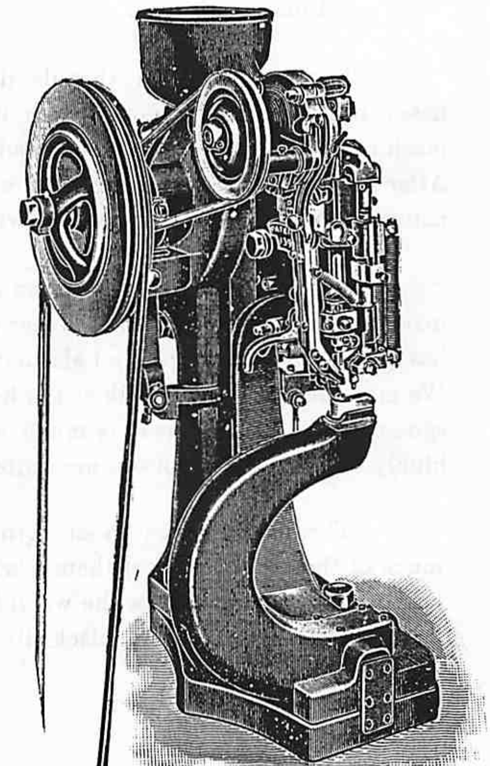
Rapid Hooker.



Punching and
Eyeletting Machine.



Plan of Machine Room.



Automatic Eyeletter.

Hooking and Eyeletting Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

(See Plate 65).

As stated in the description of the action of the sewing machine, the thread is pulled through the eye of the needle several times during the formation of the stitch, and therefore, if the thread is not of a nature to withstand the friction, it is practically worn out before it is pulled into the material. The capacity to resist friction appears to be one of the special qualities of cotton, and therefore, it makes an excellent stitching thread, at the same time it is not so elastic, and consequently not so good where there is a great deal of tension on the seam.

Linen thread is of a harsher nature altogether, and not suitable for fine or light stitching ; it makes a good thread for strong work, and is often used in shuttles with silk twist as the upper thread, but not with any great advantage.

Waxes thread machines are constructed to use the coarser linen threads, which are either treated with a waxing solution before reeling, or are run through the solution during stitching. For stitching the tops of shoes, the specially prepared waxed threads appear best. Although the ordinary shoemakers wax is not used for this purpose, the compound through which the thread is run, and which contains a large proportion of greasy matter, is an excellent lubricant for the thread, and serves as a preservative for the thread after it has been deposited in the work. The usual sizes of threads and needles are :—

Needles	...	½	1	1½	2	2½
Silk Thread	...	20 to 24	18 to 20	16 to 18	12 to 14	...
Cotton Thread	...	60 to 80	40 to 60	24 to 40	20	...
Linen Thread	...	...	...	80	60	40

The quality of all threads depend, as stitching materials, very much on their smoothness ; if the thread is not smooth it is of very little value for use in a machine ; it will cause the machine to miss stitch, break the needles, and clog up the machine with loose fluff off the thread. After this smoothness, the degree in which it will sustain the friction is of importance, and then the natural strength or breaking strain, when tested by lifting weights.

There is no doubt that cotton is the best as regards smoothness. Great care has been taken in its manufacture, and it is a little tougher than silk in resistance to the needle eye. But pure silk twist has much greater strength and elasticity than cotton, which more than counterbalances the advantage. We may therefore regard silk as the best stitching material, but this only applies to best twist, not to spun thread. Linen thread is much used for the appearance of strength ; it is very probable that highly finished lustre cottons are quite as strong as linen threads, and easier to work in the machine.

Threads also vary in strength with the colour. White silks are bleached in acids, which take much of the strength out of them ; brilliant colours have generally a large amount of metal in them—lead or iron ; this increases the weight and reduces the relative strength. Yellow silk is probably the strongest stitching material, black silk is probably the next, and then cotton.

CHAPTER VIII.

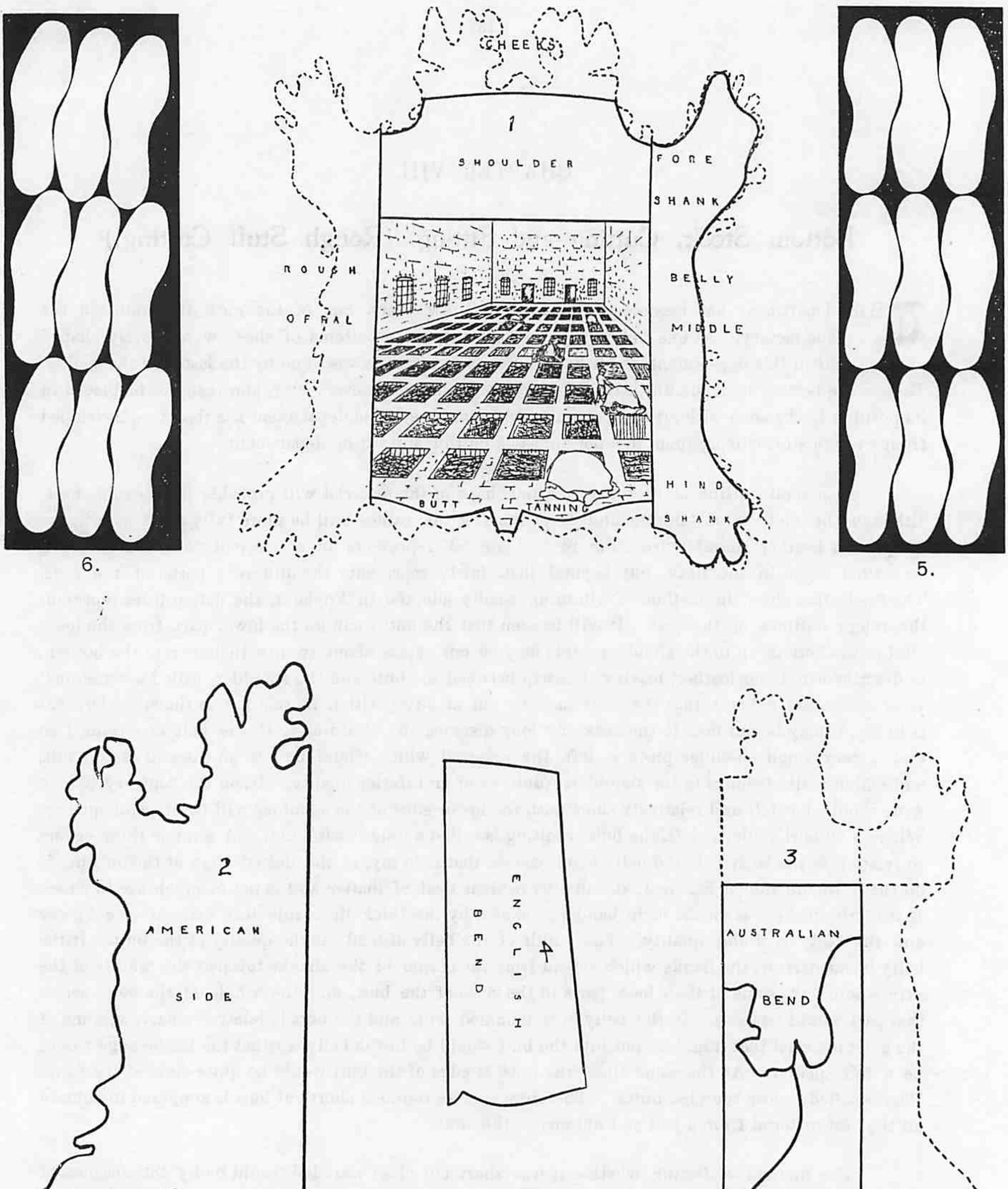
Bottom Stock, Cutting and Fitting. (Rough Stuff Cutting.)

THIS department has become, during the last few years, one of the most important in the shoe factory. At one time, the parts constituting the bottoms of shoes were merely shaped out in this department, the fitting of the parts together was done by the laster or shoemaker. To-day, the bottom stock should leave this department fitted in every way, and ready to be placed in its position in the shoe without further cutting or trimming. The department has therefore developed from a rough stuff cutting room to a bottom stock cutting and fitting department.

A general outline of the character and shape of the material will probably be advisable here, although the method of tanning and of estimating the values will be more fully dealt with in the Chapter on Leather Manufacture. Figure 1, Plate 63, represents an entire pelt; this illustration is somewhat short in the neck, but beyond that, fairly represents the different parts of the hide. The thick lines shew the method of trimming usually adopted in England, the dotted lines represent the rough outlines of the pelt. It will be seen that the butt includes the lower part, from the loose offal at the bottom up to the shoulder; this may be cut across about twenty inches from the bottom, as described in upper leather, leaving the strip between the butt and the shoulder, called a "middle." It is also quite evident that the butt may be cut at any position in relation to the shoulder, that is to say, it may be cut near to the neck or a long distance off. Naturally, if the pelt is trimmed so that a very small shoulder piece is left, the material which would be left on the end of the butt, and which really belongs to the shoulder, would be of an inferior quality. If, on the contrary, a very wide shoulder is left and relatively short butt, the lower edge of the shoulder will be of good quality. Where a wide shoulder is left, the butt resulting is called a "short cut" butt. A similar thing occurs in relation to the belly. If the belly is left coarse, that is to say, to the dotted edge of the outline, as on the left-hand side at Figure 1, it contains a great deal of matter and is not of much use in shoes. If it is trimmed off as on the right-hand side shewn by the thick line, this bad material is cut away and the belly is a fair quality. The width of the belly also affects the quality of the butt. If the belly is cut narrow, the flanks which spread from the corner of the shanks towards the middle of the skin would have some of their loose parts in the sides of the butt, and the whole of the belly across that part would be loose. If the belly was trimmed wide and the butt is relatively narrow, some of the good material that might be put into the butt would be in the belly, so that the inside edge would be a fair quality. At the same time, the outside edge of the butt would be quite clear of the flank. This is called "close rounded butts." Therefore, a close rounded short cut butt is supposed to contain all the best material from a pelt and not any of the offal.

The method of testing whether it was short cut close rounded would be by the absence of any loose places at the sides. If it is found that about three or four inches to nine inches from the bottom corner at the side that there is any signs of looseness in the butt, it is a sure indication that it has been rounded too wide; in other words the whole of the edges of a good butt should be solid

Plate 63.



Bottom Stock Cutting.

close leather. The different parts of the ordinary market hide after tanning are as shewn at Figure 1. On the left-hand side the dotted line represents the rough offal—that is to say, the belly unrounded. At the head the cheeks and faces are also left. In some very high tannages these faces are used for glue pieces, as are the rough edges from the bottom edge and the odd pieces from the sides.

When English leather is made from foreign hides it is usually cut down the middle from the shoulder to the tail, but otherwise it is trimmed like an ordinary market hide. Figure 4 represents the shape of the half-butt thus produced ; this is called an English bend.

Practically all bottom stock tanned with oak, or imitation oak tannages, are trimmed as described. There is a considerable variation in the details of the trimming, but the essential principles are as illustrated. When any other material, or any other representation of material is used, a different kind of trimming generally accompanies it. The hemlock tanned American leathers, and the combination of hemlock and oak bark, called a union tannage, are generally produced as Figure 2, which represents an American side. It will be observed that this side includes the belly, cheeks and shoulder, and the half of the butt, or English bend ; therefore, all the different qualities of these various parts are included in the side. In judging this class of material, the relative amount of offal in the entire side, compared to the more solid parts, would be the principal guide, and in this considerable judgment is required, seeing that the whole of the offal is left on. It may be taken that not more than half of an American side is fair quality stuff.

Australian leather which is tanned with mimosa or wattle bark is generally sent over as Figure 3 ; sometimes as an entire hide folded down the centre, and sometimes cut down the centre in the form of a side. For the convenience of shipping, the hide or side is folded across the shoulder and down the belly ; also sometimes across the rump, producing a square parcel ; this is then called an Australian bend. The chief ports from which it comes are Sydney and Melbourne. At one time they had distinct characteristics, the Sydney being a light flexible leather and the Melbourne considerably harder and darker. Of late years, however, the Australian tanners appear to have discovered a method of using extracts with mimosa or wattle, and the leather has consequently increased in weight, but decreased in quality and colour.

Australian leather is distinguished by a pink colour, although some of the productions have increased in depth of colour to such an extent that they are nearly as dark in shade as American hemlock. The essential character of an Australian bend is that it is soft, flexible, mellow in the working, fairly tough, and relatively very light in weight.

The American hemlock side varies very much in quality, in weight and in colour. It varies from a soft, flexible and fairly mellow, to a hard, brittle, heavy leather ; generally it is divided into acid and non-acid leather. Acid leathers are those in which strong chemicals have been used during the tanning processes, and have affected the grain of the leather, making it thin, hard and brittle. It will therefore not scour down well to form finishing surfaces, that are made with thin bottom washes, but it serves very well for finishing with paints. This leather sometimes wears very well for heavy work, particularly in wet climates. The non-acid leathers vary from a soft, lightish-coloured red leather, to a dense, heavy, solid leather, which is the hardest and best wear-resisting stock that is known. The sides vary in weight from 8 to about 34 lbs.

The essential peculiarity of hemlock leather is, that it is hard, very dense in fibre, strongly repellant to water, and relatively heavy in weight. It is the nearest natural waterproof leather known.

Union tanned leathers, that is, the combination of hemlock and oak bark or oak extract, is light red in colour, very tough, much lighter in weight relatively than hemlock leather, but somewhat heavier than pure oak. It forms an ideal leather for medium weight work for ladies' wear.

A great number of different kinds of tannages are commonly referred to as oak tannages. Oak bark tannages, *i.e.*, leather produced from oak bark only as a tanning agent, is light fawn in colour, rather soft in its nature, very long in the fibre, very tough. It does not resist water very well, but it forms an excellent leather for dress purposes, or to be worn over sand or grit of any kind. Leathers are commonly termed oak leathers if they are tanned from a mixture of oak bark and valonia; this is quite a correct expression, because valonia is the acorn cups from oak trees, and is therefore more or less oak; but the leather is quite distinct from oak bark leather. Valonia naturally produces a brown leather, harder, heavier and more brittle than oak bark leather. In many respects, the character produced by valonia, makes the leather more valuable than pure oak bark, but this is only in the case where a small proportion of valonia is used with a large proportion of oak bark. Valonia by itself would produce a very dark, brittle leather, in fact, if sufficient valonia were used the leather might be made black. This causes several combinations of valonia with other tanning agents, and the only tanning agent that is a very real advantage to use with valonia, is oak bark. All others produce a lower grade of tannage of leather.

Common oak leathers are usually produced from valonia and myrobalans. Myrobalans by themselves produce a soft, yellow, badly-coloured leather, which in some parts of the pelt, produce horny, brittle patches. Used with valonia, it corrects the colour, and to a certain extent corrects the character, but the standard of quality possible, by the use of valonia and myrobalans is much lower than that to be obtained by the use of valonia and oak bark, or oak bark extract. The leathers that are, by a stretch of imagination, called oak leathers, are frequently produced by combinations of valonia, extracts, and gambier; are brownish yellow in colour, which forms a comparison with the brown fawn of oak and valonia; and generally, the low grade oak leathers are stained along the edges a kind of dark blue or violet, although this is sometimes corrected artificially.

The different parts of the hide after tanning are generally used for certain definite purposes, which are nearly always constant, although there may be slight variations for peculiar classes of work. The butt portion is commonly used for the parts that actually come in contact with the ground, that is to say, for the soles and the top piece of the heel, and naturally, the bend and the portions which represent the butt in the side are used for the same purpose. The shoulder and the best part of the belly are used in parts that hold the seams—the seam between the sole and the inner sole, that is to say, they are used for insoles and middle soles. The lighter and softer portions, as the shanks and the cheeks and faces, are used for the stiffening portions of the boots and those parts that are not subjected to much wear; in other words, for stiffenings, shanks, and lifting.

The proportional amount of each one of these parts which is used for the purpose stated, depends upon its quality. Naturally, if the shoulder is a very high quality, the best of it may be used for some kind of light soles, in fact, the shoulder is sometimes used for the soles of ladies' dancing shoes, or for the soles of babies' boots. The cheeks are commonly used for lifting, but if they are of

very good quality, the best of them are also cut for babies' outer soles. The use to which the bellies are put vary with their substance and their quality. The belly middles, if a good substance, are commonly used for insoles for machine welted. If of light substance, they are used for insoles for McKay or Blake sewn. If the bellies are stout, the fore shanks and hind shanks would probably be stout enough for McKay sewn insoles. If the bellies were light, the shanks would be used for stiffeners. In all cases the odds and ends of pieces that are left from cutting the large pieces, such as insoles and stiffenings, are used for heel lifts or half-heel lifts.

As the general character of the tannage effects the character of the offal, it naturally follows that insoles that are required to be mellow cannot be cut from the belly of American sides, and therefore, the offal from American sides has to be used for those parts which may be stiff although loose in character.

The different classes of attachment require different kinds of material to be used in the various parts on the inside of the bottoms. Machine welted insoles should either be of light substance, and long and tough in the fibre, or should be of stout substance and density to carry a welt seam. The first kind of insole may be secured from good bark-tanned bellies, the middle of a bark-tanned belly naturally producing the kind of insole required. The shoulder and belly of Australian bends usually contain leather of sufficient density and lightness in weight for a stout machine welted insole. This only applies where the mimosa tanned leather has not been artificially weighted. Where it is not advisable to use either one of these leathers, it is generally more economical to use an artificially prepared insole from a combination of leather and canvas as the "Gem." Hand-welted insoles may be about two grades lighter than machine welted. If they are required very light they must be very mellow, so that the inside sewing seam may be sunk in the flesh of the insole without a shank.

McKay sewn work may have the lightest insole possible if it is of sufficient substance to permit of the upper being tacked down to it. If not sufficiently stout for this purpose, it is usually backed or supported by a second layer. The essential character required in a high-class McKay sewn boot is, that the insole be sufficiently thick to permit of the upper being tacked to it, and that at the same time it is light, flexible, and mellow. Below this grade almost anything may be used. The McKay seam may be made solid on a piece of calico pasted on to mill board.

Vertical metal seams have to be provided with solid insoles. The Standard Screw Machine, or a rivetted seam, requires the insole sufficiently thick and solid to make a good seam with the worm of the screw or the clench of the rivet, quite independent of the other parts of the shoe. It may be taken that the screw seam requires insoles a grade stouter than the welted seam. Fastenings that are clenched from a turned wire, like the Staple Tacker or Wire Grip, may be made with a grade lighter sole than screwed or rivetted.

Outer soles, apart from what is actually required by the boot or wearer, and considered from what is required by the machine, have to be selected in proportion to the depth of the channel made to carry the stitch. McKay sewn work has either to be sewn on the ordinary McKay or Blake channel, which is naturally a deep channel, and which requires a considerable substance in sole to carry it, or the grain has to be split from the edge of the sole, and afterwards laid down to cover the seams. Machine stitched channels, which may be nearer the edge than in McKay sewn work, and which is

made with a lock-stitch machine, has a much shallower channel, and consequently may be made with much lighter grade sole. Rivetted work, which is held by the head of a rivet, may be made with a light outer sole. Screwed work has to be a grade stouter, because there must be enough substance to be held by the worm of the screw; this also applies to pegged work which requires sufficient substance in both sole and inner sole to carry the pegs, and to form a solid seam by the clenching of the peg on the inside, and the contact of the peg on the outside.

Stiffenings should be solid but light, it is very little use putting in thick but soft leather for stiffenings.

Lifting may be of any character, providing that all the leather in one heel is of the same density. The cause of unsolid work is generally that the different lifts making up the heel are of various degrees of hardness, and do not all absorb water and swell and shrink in the same degree. Consequently, as they shrink unequally, they naturally crack and produce unsolid heels.

The middle soles will vary in their quality according to their purpose. If they are intended to carry a row of stitching, commonly called "fair stitching," the grain must be sufficiently solid to hold the stitch. If they are Blake or McKay sewn right through, and the welt will be fudged, a softer middle may be used.

There is considerable difference in opinion respecting what is the correct way or most economical way of cutting soles for bottom stock. Generally, the leather used for sole leather, is sufficiently clear to admit of a systematic arrangement of the cutting shapes, and it therefore becomes a question as to what system produces the greater number of soles out of a given area. Some manufacturers prefer to strip the sole stock into straight ranges or strips, and then to cut the soles across the strips. There is no question as to the convenience in this method, but it is certainly not economical. Much, however, depends upon the shape of the cutter. A straight form cutter with about the same swell each side of the joint, will cut straight up and down, so that when the joint is bedded in the waist the result is practically a straight line. This method is shewn in Figure 5, Plate 63, by which it is seen that although there is some waste, the sole shapes could hardly be blocked in any closer. If they were cut out as shewn, that is, without stripping, irregular shaped pieces would be left which might be utilised for some purpose. If the leather was stripped straight across, these pieces would be halved or divided, and would then be of less value through being so small. It is therefore best to cut direct without stripping, cutting the first row straight along, then for the next row, either turning the leather over and cutting soles for the other foot, or using a special knife, the fellow one to the previous one used.

If the shape is of a twisted form, they would not produce a straight line across the leather if blocked closely in. It is therefore best to cut them as Figure 6. This leaves a tolerably large triangular piece next to the first cutting edge, but cuts very closely across the material. Plate 64 illustrates several methods. Figure 1 represents a butt marked out for straight ranges or stripping. If the whole of a butt being good enough for sole leather, the usual practice is to commence to strip from the fore end; this would leave the lower end next the tail, to be used up for top-pieces, or if sufficiently wide, to take soles across the butt. If the fore-end is too light for sole stock or too common in quality, the stripping would commence at the tail end, so as to secure all possible soles,

Plate 64.

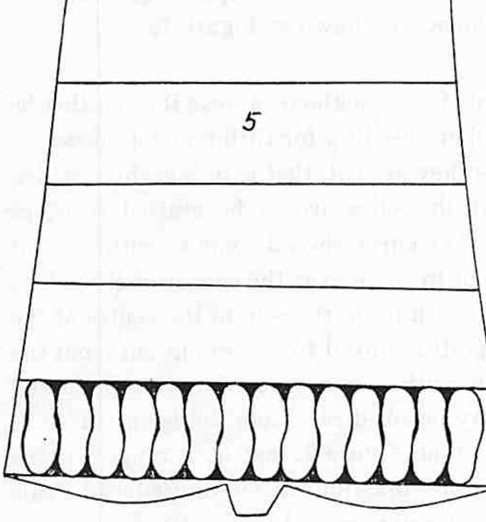
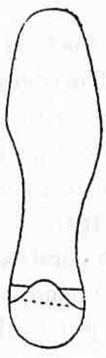


Figure 1.



Making Graft.

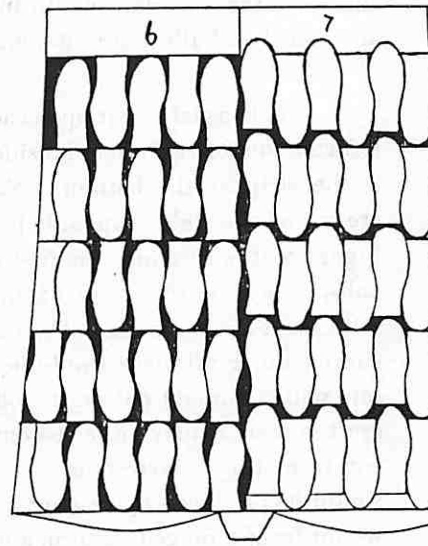
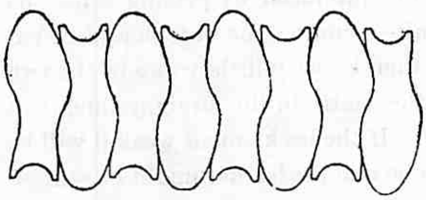
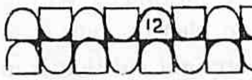


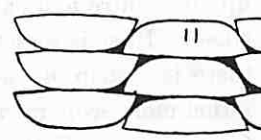
Figure 3.



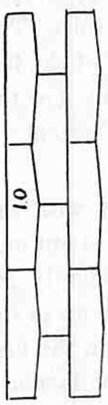
Grafted Range.



Heel Stuff.



Shoe Stiffeners.



Boot Stiffeners.

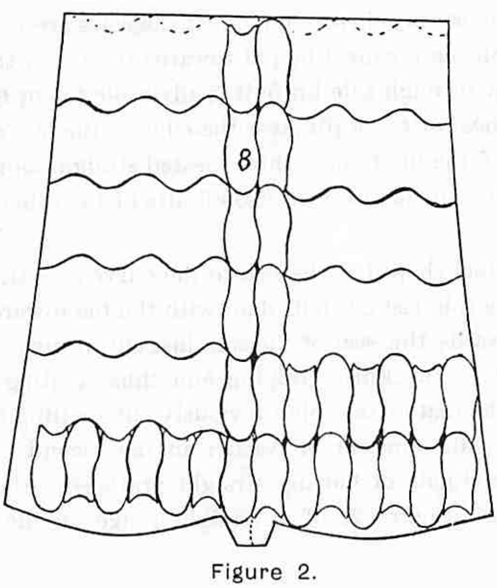
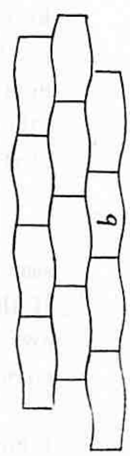


Figure 2.



Middles.

and leave the uncertain width in the common or light stock. The number of strips being taken off and rolled and allowed to get mellow, the cutting would commence as shewn at Figure 1.

It is usual to cut upon each side of the backbone, so that if the backbone is weak it can either be left right out or cut into the inside joint. The edges at each end are used up for lifting or top-pieces, as is the strip at the bottom. Naturally, these soles pair up as they are cut, that is to say, those which are cut on the right-hand side pair with those on the left. If the soles are to be grafted seats, as Figure 8, it is certainly the best plan to make a curved graft. The curve should come to within about half-an-inch of the front of the heel. If the heel graft is cut to come over the corner of the sole, a solid seam can be made. The centre of the graft should come flush up to the sole in the centre of the curve; this graft piece would be about the same size as the graft required for a straight cut; but the sole with a straight cut graft would take up more leather than with a curved graft. If the curved graft is used, it may either be cut with a curved range or it may be cut direct from the bend. If it is cut from the curved range it would be in the manner shewn on Figure 2, that is, a range pattern would be produced by placing the soles alternately heel to toe, and drawing the curve produced; this would form a ranged pattern, and the ranges would be taken straight across in a similar manner to a straight strip.

If a butt is being cut up and it is desired to cut it direct, the most economical method is to cut a curve down the backbone, as Figure 2. This curve would also be produced by placing soles one after the other in the correct position, and then drawing the result in curve; the butt should be cut up the centre to a pattern produced from this curve, there would then be very little waste in the two edges. If, as is sometimes the custom, that the butt is split down the centre in the straight line, then there is a strip on each side of the straight cut that is mere waste. If the backbone is weak it will be rather more economical to cut an inch or so each side of the backbone so that the leather might be utilised for top lifts. If this curve-graft method is used for cutting bends such as American sides, care must be taken in cutting the first sole, so that the toe of the sole coming above it has sufficient room; this is shewn in Figure 2. The first sole on the right-hand side is pushed sufficiently far forward to admit of the sole above it being cut down to the edge of the rump. If the sole had been dropped lower, the next sole could not have been fitted in. If the knives are made of the shape of the curve graft, the soles may be cut from almost any direction; but if the soles are cut by this method by through sole knives, the heel of the sole cutter must be put towards the toe of the shape last cut out. Therefore, in starting the row with a through sole knife it is advisable to cut the first sole a through sole. The next sole is cut with the heel of the knife over the edge of the last cut, cutting the toe out of the last sole cut out of the heel of the next one; this repeated straight along produces the system. For the next row the leather is either turned over or a sole knife of the other foot used to keep the system.

Even with sole cutters shaped at the seat to the curved graft, it is far better to cut with the seat towards the toe of the sole last cut out, than with the toe towards the seat of the toe last cut out. If the toe is arranged towards the seat of the sole just cut, it must either be drawn sufficiently far away to obviate the effect of the knife slipping and thus spoiling the toe, or if put close up to the edge there is a danger of the seat of the sole previously cut spoiling the shape of the toe. In the first case there would be a certain amount of waste; in the second case some danger of spoilt stock. Figure 3 represents two methods of cutting straight grafts—by the straight range and by a similar system to that described on Figure 2. The straight range on the left-hand side of the Figure is

probably one of the worst methods by which sole stock could be cut out; but it is in common use by some manufacturers who think they are practical men. As is seen upon this diagram, there is considerable waste between each cut; this waste is intensified with the extra prominence of the outside joint. A sole shape having about equal prominences on each side of the joint is not so very wasteful; but if the inside joint is somewhat straight, and the outside joint very bold, then the waste is very great. In any case the system is only fit for single pairs, and should not be used for any person professing to be an up-to-date manufacturer.

Straight grafts may be cut with a fair amount of economy by the system shewn on the right-hand side of the Diagram. By this it is seen that the sides of the sole shapes fit in fairly close. This can be arranged with any shape sole knife, because the knife could be drawn either backwards or forwards until the best fit is secured. The only difference as regards economy between this method and the curve graft method is in the piece that the toe of the sole may cut out at the curve graft compared to the straight line across the straight graft, it amounts on an average to quite an eighth-of-a-penny per pair difference.

The whole question of these grafts should be carefully considered, because the amount saved in the rough stuff cutting department is not all saved in the manufactured boot. The total saving in cut stock is represented by the difference in value of the leather for which the sole is cut, compared to the leather from which the graft is cut. The graft itself represents about 1/6th of the sole, and assuming that the graft leather was worth about half the amount per lb. of the sole leather, the saving on the curved graft in material would be 1/12th of the value of the soles. This is quite as much as it actually works out in practice. Against this there is to be set the labour of attaching the graft, the extra labour in the making of the boot, the extra cost in the finishing room, and the fact that the grafted seat is not so good as a solid seat. Where straight grafts are cut on the system shewn on the left-hand side of Figure 3, the grafted sole costs quite as much as a through sole, and has the disadvantages naturally in grafted seats.

These soles should be sorted out into substances and arranged upon a system similar to the specimen scale given. This scale shews the weight per dozen pairs, the substance in inches per dozen pairs, the price per lb., and the price per dozen pairs; but the weight per dozen pairs would be very simply ascertained after the sorting, and in giving out cut soles, the scale is the best indication of the relative value of the soles and the cutting value of the leather. If it is found that certain leathers are producing soles which are light in substance in proportion to the weight, it may safely be assumed that the leather is being wasted, or at any rate it is cutting too dear. The price per lb. would be determined from the cutting sheets. If we assume that six pounds of leather at 1/9 produce twelve pairs, and a certain amount of waste that was of no value, the cost of the soles would be 10/6. If we weigh the soles after cutting, and discovered that they weighed 5-lbs. 12-ozs., then their cost per lb. would be considered 1/11; this then would be the price per lb. for material; the cut stock would have the cost of cutting added. In taking stock, the amount might be taken in pairs or in lbs., each would be equally correct, assuming that the substance was to the estimate.

Soles may be sorted into about seven substances; these substances should not be confused with quality. A sole may be very stout but still of a common quality; qualities being equal, the stoutest sole is of the greatest value. After the soles have been sorted out into their substances, twelve pairs of each substance should be measured—that is to say, the height of twelve pairs placed one on

the top of the other should be taken as the sole gauge for that substance. If this height is divided into twenty-four, we have the substance of one sole ; the number of 24ths-of-an-inch in this sole is its number. Soles gauged per dozen pairs, respectively, 3, 4, 5, 6, 7, 8 and 9 inches would equal 1/8th-of-an-inch for the thinnest, and increase by 24ths to 9/24ths. Naturally the substance register or gauge would be constant for all leathers, the variations being in the weight per dozen pairs, the price per lb., and the price per dozen pairs. These variations are caused by the different relative weights of the various kinds of tannages, and indicate the relation between weight, price per lb., and value. After the first scale has been produced, an analysis will shew the difference between the relative weights. In the specimen produced from actual practical experience, it is found that where oak bark butts weighed 4 lbs. 8 ozs. per dozen pairs of substance No. 5, American union weighs 5 lbs. ; Australian bends, 5lbs. (pure mimoso tannage) ; English bends, 5 lbs. (oak and valonia) ; American oak, 5 lbs. $14\frac{1}{2}$ ozs. ; American hemlock, 5 lbs. 12 ozs. It will be seen from these relative weights that the different tannages vary considerably, and that naturally as the prices of the tannages vary also, the price per lb. varies with it.

This principle should be applied to middle soles, insoles and other parts of the bottom stock. As mentioned before, there is some difference required between middle soles for stitching, and those required for sewing. The stitched middle is naturally required harder on the grain and denser than that for sewing. These differences, although quite apparent in practice, have an exceedingly slight effect on the weight of the material used in middles ; but the quality of the middles for stitching is unquestionably higher than that required for sewing, and supposing that the weight did not vary sufficiently to be of practical effect, there would still be an increase in the relative value ; *i.e.*, a solid middle sole suitable for stitching is of greater value than a comparatively soft middle, which is not sufficiently solid on the grain to take a stitch, but which will do very well for the impression of a fudge wheel. The differencs in the widths of welt naturally affect the weight per dozen, and cost per lb. and dozen pairs, but of course have no difference in the gauge of substance. The weights given are for ordinary close welts, an allowance of 15 % on these should be made for half-wide welts ; 30 % for wide welts. This may appear excessive, but it has been found in practice that the additional difficulty of cutting very wide soles causes a loss of material which equals the amount given, although it is evident that the amount of stock added to the sole for half-wide welts and wide welts does not equal the percentage added to the price—See Scale.

Specimen Scale.

Soles with heel graft—3 (C) Fitting. Close welts.

No. of edge and substance in 24/ths-of-an-inch	...	4	5	6	7
Oak Bark	Weight per dozen pairs—	3 lbs. 10 ozs.	4 lbs. 8 ozs.	6 lbs.	6 lbs. 6 ozs.
English Bends	ditto	4 lbs.	5 lbs.	6 lbs.	6 lbs. 13 ozs.
Australian	ditto	3 lbs. 14 ozs.	5 lbs.	6 lbs. 2 ozs.	
American Union	ditto	3 lbs. 14 ozs.	5 lbs.	6 lbs. 3 ozs.	
,, Oak	ditto	4 lbs. 5 ozs.	5 lbs. 6 ozs.	6 lbs. 7 ozs.	
Hemlock	ditto	4 lbs. 1 oz.	5 lbs. 12 ozs.	6 lbs. 14 ozs.	7 lbs. 7 ozs.

Bottom stock should be sorted for substance in the same grade as the edges are entered in the stock book or sample book. Seeing that this should have some relation to the grade of the edge

trimmers, and that they are usually graded to 48ths-of-an-inch between numbers, that amount should form a good working basis for the grade of soles.

If that amount is taken as the grade, the numbers would represent the same as the finishing kit; but most bottom stock sorters would consider the difference too fine, and therefore twenty-fourths will be taken as the difference between numbers, and the grade of soles based on that. If we enter the numbers as the scale, the soles may be sorted in this order.

Edge Number ...	1	2	3	4	5	6	7	8	9	10	11	12
Substance when finished	1/24	1/12	1/8	1/6	5/24	1/4	7/24	1/3	9/24	5/12	11/24	1/2
Sorting Number Soles			3	4	5	6	7	8	9			
Sorting Number Middles	1	2	3	4	5	6						

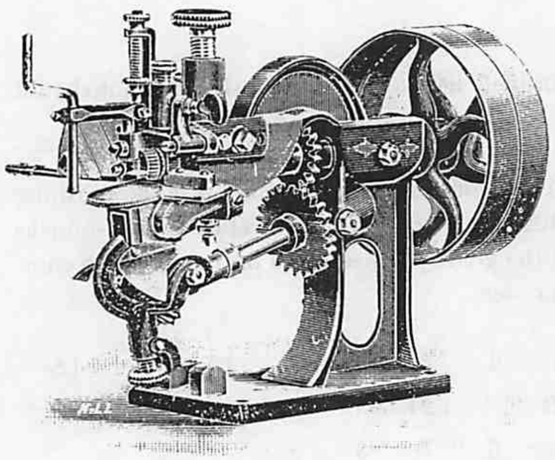
The lightest sole used would not be less than 1/8th-of-an-inch, and the stoutest not more than 1/3rd or a little over; the sorting would be in seven substances, from 3 to 9. Middle soles are cut from lighter stock, and do not have deep channels; in some cases they are used for slips, these can be graded down to No. 1 and up to 6. From thus sorting, it will be quite easy to make up an edge, and to vary the proportion of sole to middle, according to quality. For instance, a No. 8 edge could be made up from a 6 sole and a 2 middle, or from a 5 sole and a 3 middle; in each case the number of the sole and middle added together make the number wanted in the edge.

These numbers would not always represent the thickness that the sole would be in the boot, much would depend on the method in which the edge was made up, and the amount that the leather became thinner in the working; some leathers shrink in the working a great deal, others very little, that must be a matter for experiment. The amount of difference having been ascertained, the sole would be counted as so much lower as an edge-making substance; as an instance, No. 7 butt sole would work down to a 6 in the bottom. Single soles would naturally count lower than their substance by the gauge. The flesh side would have to be ploughed away to provide a finishing surface; this would take about two numbers, and therefore a No. 6 sole would count as No. 4, if used for single soles. Middles would count one size down, to provide for the finish of the welt. If the stock was graded upon this principle, the number would indicate the inches the stock should measure for twelve pairs, if piled up; for instance, No. 6 would be soles of a substance that when twelve pairs were placed in a pile, one flat on the other, they would be six inches high, and all other numbers would be on the same principle.

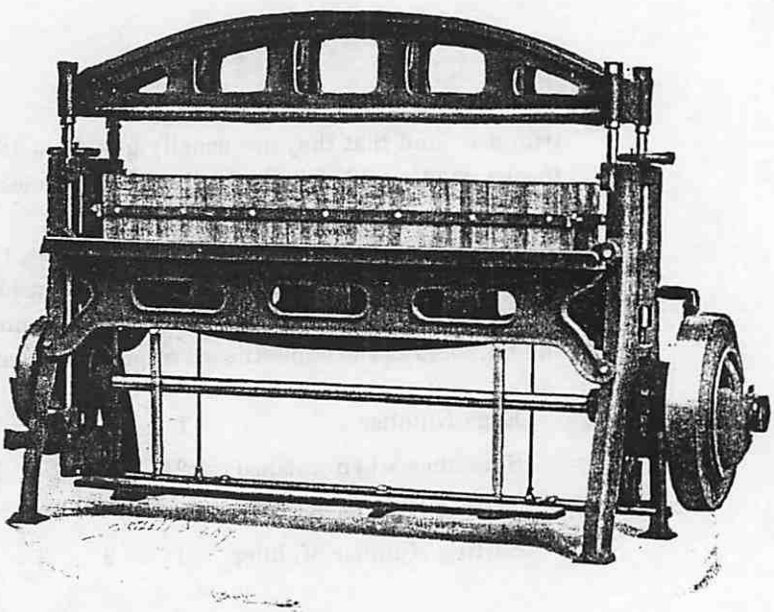
Most classes of bottom stock are subjected to a rolling process before they reach the shoe manufacturers; but it is usual to hammer or roll oak tannages, particularly those that are cut into soles. The hammering consists of beating the cut sole upon an iron anvil—usually the bottom of a flat iron. This beats down the fibres and makes the leather harder and more solid without straining the fibres. The rolling of the leather between metal rollers is a substitute for the hammering, but does not quite produce the same result; the leather is considerably extended by the rolling, and although the surface is made harder the effect is not quite the same as that produced by hammering.

Leather that requires hammering or rolling should be thoroughly soaked in clear water. This may be done in a tank as shewn on the plan. It should then be drained until mellow—that is, without

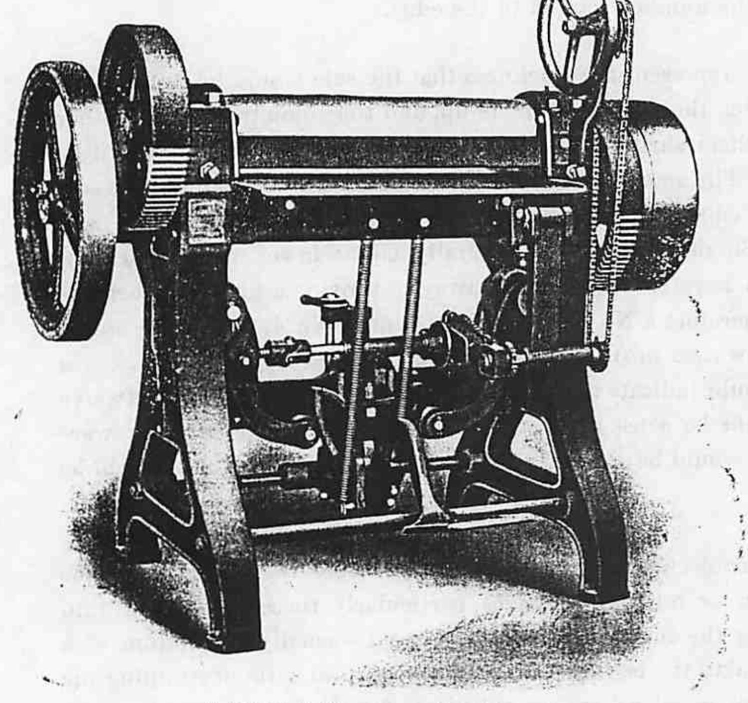
Plate 65.



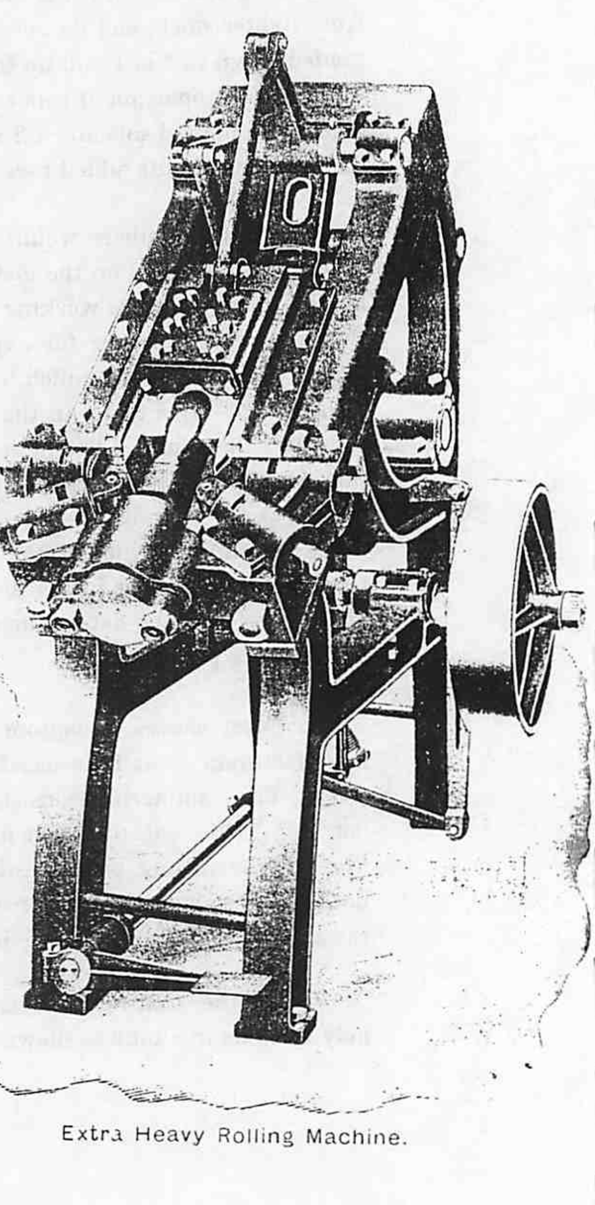
"Watson" Counter Skiver.



Revolution Cutting Press.



"Joung" Counter Moulder.



Extra Heavy Rolling Machine.

Rolling, Cutting, Skiving, and Moulding Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

(See Plate 66).

visable moisture on the surface, but wet in the fibres. This "samming" is best done in a subdued light; in fact, all bottom stock should be kept as much as possible from much light or heat.

When mellow, the stock should be rolled through heavy rollers, as shewn upon Plate 65. If one of these rollers is brass, or gun metal, the grain of the leather should be placed next to it during the rolling. If both rollers are of iron, the rollers should be wiped clear of water as often as it collects. If this cleaning is not done, some straining of the surface is sure to occur. The water from the leather contains some tannic acid from the leather, this combines with the iron surface of the rollers, forming a tannate of iron which is black.

The Heavy Power Rolling Mill will roll stock up to five feet wide, and of any substance. All these machines require some care in the regulation of the power applied; leathers of entirely different natures should not have the same pressure applied to them. Hemlock, when rolled at all, may have the greatest pressure without much harm; but a soft, clean-faced leather, which is required to take a clear buff finish, should not be excessively rolled. This machine will take practically all classes of bottom stock used in shoes; but it is advisable that a small machine should be included in the plant, for the purpose of rolling small pieces when the larger machine is being used.

If the stock is wetted in the side or bend a draining bench should be provided; if stripped or ranged before rolling it, may be hung over copper wires, or a small hole punched in the corner of each range and hung on hooks or nails. Ranges or strips extend in width during rolling about a third-of-an-inch, or a size; therefore, all ranges before damping and rolling should be one size short.

All bottom stock is not improved by rolling, but only experiment can detect this. Some leathers that are thin on the grain are made still worse by rolling; others appear to rapidly darken after wetting. It appears that the water acts upon the tanning agent in the leather and produces a combination that is darker than the leather. In most cases the darkening takes place with great rapidity in sunlight, but comparatively slowly in darkness. It is therefore advisable to have dark cupboards where these wet soles can be piled during drying. If it is found that soles stain if dried in the ordinary way, it is advisable to pile them while wet, grain to grain, and flesh to flesh, in a dark place. When fairly dry, put them into work; bottom stock does not change colour very much in the dark. The cause of these stains is the combination of the water with the tanning material, which always results in a change of colour; if the leather is thoroughly soaked, a change takes place all over the leather, and is not particularly noticeable; if the wetting is greater in some places than in others, the change of colour is irregular and results in a stain. The damping of soles for channel laying should be thorough or not at all. But if the stock has been thoroughly wetted once, it will not be very liable to stain afterwards.

Leather also varies in condition, according to the amount of moisture it contains. The difficulties of fitting up to exact measure of edge is mainly caused through this difference; some leathers roll down considerably, others very little; they also differ in substance according to the degree of moisture in them. A really wet leather is thicker than when it is dry, as it is rolled the fibres are laid down, and the moisture causes them to stick, and so produces a thinner substance. As they dry the fibres naturally separate and, so to speak, fluff out, and the substance is thicker than when wet and freshly rolled. All this causes some uncertainty as to the value of leathers as edge-making substances. It would be advisable to take the thickness when the sole is mellow, neither wet

or dry. It may safely be assumed that the sole will go down in the working to about its substance when mellow after rolling.

Some classes of stock may be levelled by splitting substances, etc., before cutting. Where the piece to be split is large enough to be used for different shapes, it is the best plan to split the whole piece; this will allow of the split-off portion being utilised for the purpose it is most suitable for. If the splitting is simply a matter of levelling or making even, then the work can be done after cutting.

Sole cutting from sides is most conveniently done on a Revolution press, as Plate 65. The side is laid with the straight edge towards the operator, who places the knife so that the heel of each succeeding sole is placed towards the toe of that previously cut. He should cut the first sole so that there is room on the stuff for the one to be cut above it. If he starts left to right, the next row should be right to left—See Plate 64, Figure 2.

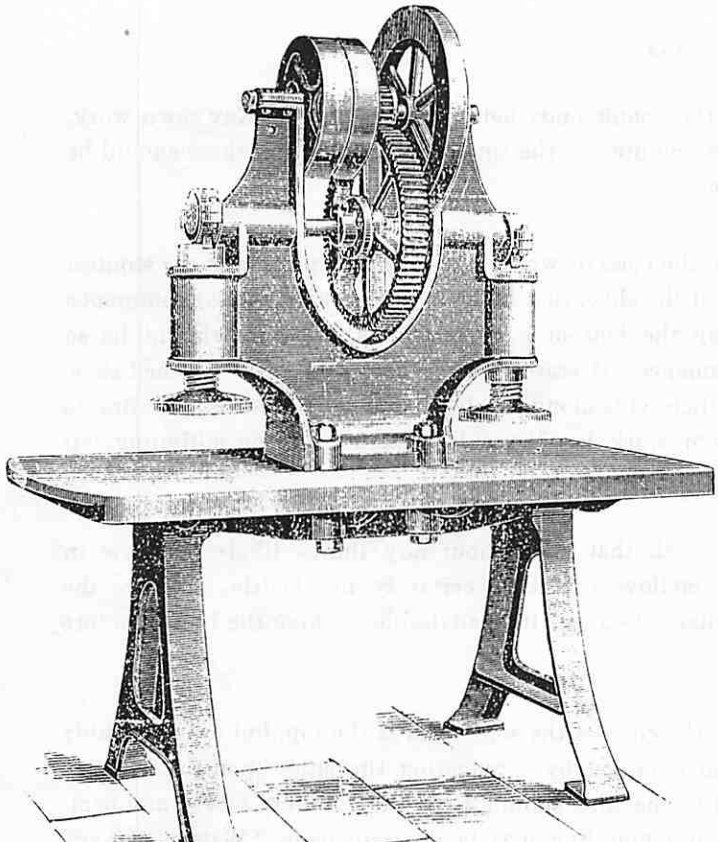
Soles cut from ranges or strips may be cut on the Double Open End press, illustrated on Plate 66, or single press, Plate 67. This press is designed for the cutters to handle small or irregular pieces, like bellies, quite easily on the press.

Where soles are cut to a stock pattern, they would be rounded upon the "Hartford," "Julian," or "Planet" rounding machines. The stock patterns should be of at least three different shapes, and all in square toes. If they are cut for grafted soles, they will work up and down for other fittings. The stock fitting should be C 3 or medium fitting; by grading up and down an extra size each way, a B fitting size 8 can be cut from 7 C, and D fitting size 6, also from 7 C. By arranging the stock dies in this maner, a smaller stock is wanted than if separate dies were kept for each fitting. Some manufacturers prefer to cut stock to the actual shape of the sole, cutting to square toes and rounding the toes off only. This is a good plan where the range of shape is small; that is, if the manufacturer has most of his lasts exactly the same shape from seat to joint, and simply makes a difference in the toes; but either method requires the use of a rounding machine. These machines consist of a clamp which holds the sole and a wood pattern, while they are acted upon by a knife. In these machines the knife is drawn towards the pattern by a spring, and when in contact, has its cutting edge level with the pattern, then either the clamp revolves, bringing the leather against the knife, or the knife is carried round the pattern; in either case cutting out the sole. This type of machine is shewn upon Plate 66.

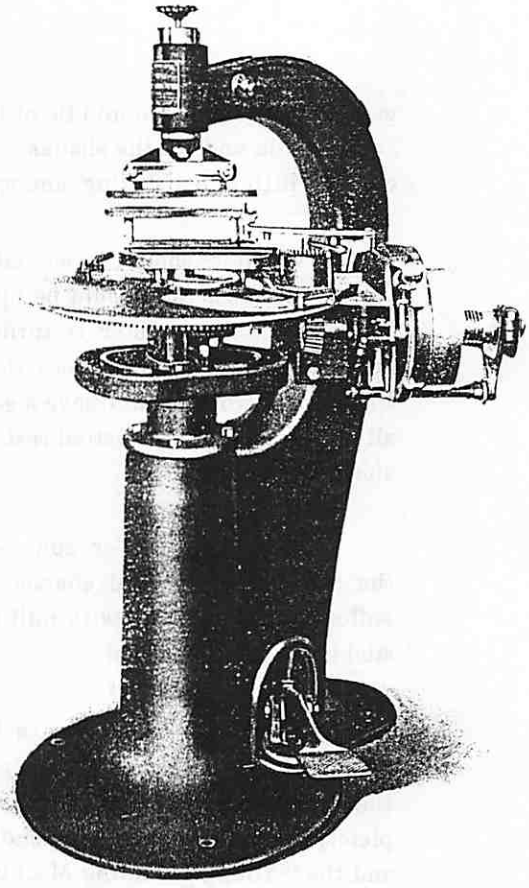
After rounding or cutting and checking, the sole is evened, or it may be put into stock and evened up afterwards. But there is no doubt that all soles should be made of a regular substance; it is a great advantage, and the saving of time in subsequent operations more than compensate for the time spent on the process of splitting. The "Summet Sole Evener" is shewn on Plate 66.

After rounding, the soles are stamped; this may be done by the Power machine—Plate 66. The distance from seat or toe being fixed by a regulator, the stamp is fixed in a vertical plunger, and all cut parts can be stamped with a great rapidity.

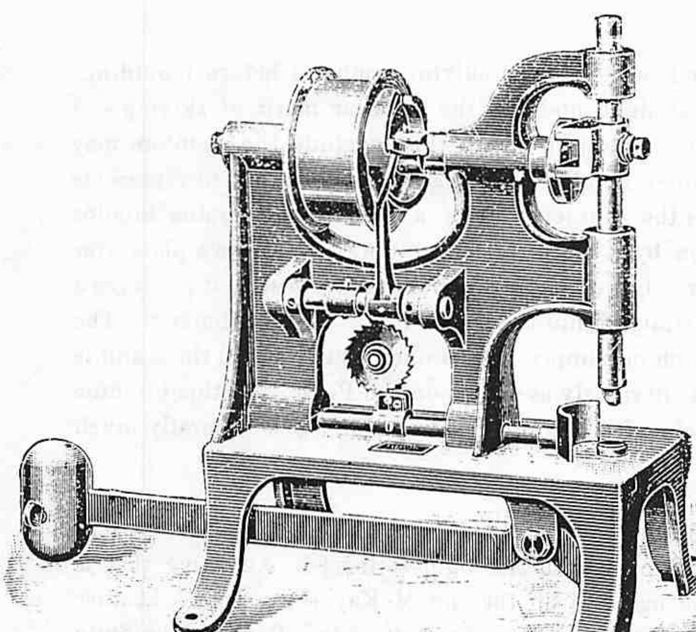
As a rule, the larger parts of the bottom stock are most easily cut under the press; but small pieces, as lifts, shanks, small stiffeners, and very small insoles, are cut much quicker by the use of the mallet; or by a special quick-running light press. Insoles are cut as closely as possible, having regard to the shape and substance of the material, and the purpose they are intended for. Welted insoles are



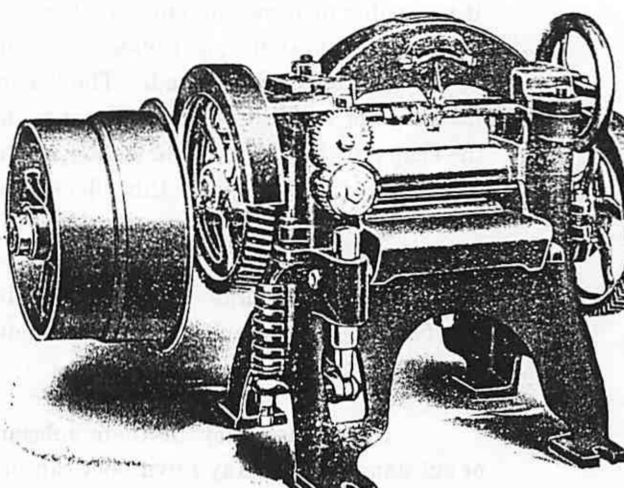
Double Open-end Press.



"Planet" Sole Rounder.



"Wigston" Sole Stamper.



"Summit" Sole Evener.

Cutting and Evening Machines by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

(See Plate 69).

generally cut from the middle of the bellies ; the shank ends being utilized into McKay sewn work, and the thin ends of the shanks into stiffenings (counters) ; the small pieces left from these should be cut into lifting, half-lifting, and splits or runners.

Counters should be skived according to the class of work. As a general principle, the stoutest part of the substance should be upon the edge of the shoe, that is to say, the skive should commence from where the counter is turned over along the bottom edge. The other edges should be so graduated that exactly where the skive commences is scarcely to be detected in the finished shoe. Blake sewn work should have a skive half-an-inch wide along the bottom edge : this also applies to all machine-made or rivetted seats. Hand sewn work has the full substance of the stiffening left along the bottom edge.

All stiffenings or counters must be level, that is, without any lumps likely to shew in the boot. The general character should be mellow and firm, certainly not brittle. Where the stiffening is backed up with mill-board or similar substance, it is advisable to skive the backer before sticking it to the counter.

Counters should always be stiff from the edge of the sole towards the top, but are preferably mellow along the sides. This result may be obtained by corrugating the sides upon the machine shewn on Plate 72. Work that is to be lasted by machine should have the counters skived and completely moulded. The two operations, skiving and moulding, may be done upon the "Watson Skiver" and the "Young Moulding Machine"—See Plate 65. Work lasted by hand usually have the counters moulded along the sides without turning the bottom edge ; this provides for the fitting of the counter, and permits the hand-worker to last in the seat.

The "Watson Counter Skiver" is designed purposely for skiving counters before moulding; it is capable of bevelling curved edges as well as straight, and has the peculiar merit of skiving soft and unlevel substance, as backers to counters and composition : with this machine the counters may be skived after being backed. The "Young Counter Moulder" consists of a block which represents the shape of the seat of the last, and round which the counter is fed ; a blocking apparatus moulds the shape of the sides, while a slide, put in motion by a crank action at the back, forces a plate over the edge of the mould ; this blocks the lower edge of the counter over the seat, and produces a perfectly moulded counter, which can be put straight into the shoe without further shaping. The machines are made single or twin—the single machine simply blocks one counter at the time, and is sufficient for a moderate output ; the twin blocks alternately as shewn on the Plate. By this machine the feed is continuous, while one mould is being fed the other is in action ; it is naturally much faster than the single.

Inner-soles vary in their substance according to the method of attachment. In the order of substance the McKay sewn boot can probably be made with the lightest insole. Anything that is sufficiently strong to carry a crotchet stitch can be made to do for the McKay sewn boot. Leather that is fairly mellow but very thin, may be backed up with other materials. It would be quite possible to make a sound boot with a canvas insole, in fact the writer has seen very good insoles made from plaited straw. Generally speaking, for good class work, the offal from oak-tanned leather produces very good insole for Blake or McKay sewn work.

The hand-sewn welted boot can also be made with a very light insole. It is quite possible for the workman to make a sewn seam through the flesh of the insole without cutting a channel or groove, but it is indispensable that the leather used shall be long in the fibre, tough and well tanned.

Machine welted work naturally requires a stouter leather insole unless some combination of leather and canvas is used. The leather insole must be stout enough to take the channel on the flesh side; and the split edge representing the rebate of the hand-sewn boot. If a light leather is used, it should have the character of that used for hand-sewn work, that is, it must be tough, and of high quality. A much stouter insole would be wanted if the leather was shorter in the grain, briefly, the insole must be either tough or stout.

Insoles are often required to be flexible; there appears to be an idea that if the insole is flexible the whole shoe will have this character; this is not quite correct, because the character of the shoe depends very much upon the nature of the seams by which it is attached. Insoles, however, may be made flexible in a similar manner to that used for counters. This is by making a number of cuttings or scorings across the insole upon the flesh side; these scorings being over the parts not occupied by the seam. A special machine for this purpose is shewn upon Plate 68, called the "Flexible Insole Machine." Special attention has been given to this matter in reference to insoles for machine welted work, and a special machine has been produced for making a flexible insole, that is a combination of leather and canvas. This is probably a most practical method of producing a flexible insole, which is also light in weight and makes a perfectly solid seam. An illustration of this machine—the "Gem Flexible Insole Machine," is shewn upon Plate 68. This insole consists of a very light leather insole, in fact too light to be used without special treatment and a backing of stout canvas. The insole is channeled by two cuts, one curved and one straight, throwing up a ridge; the flesh of the insole with the ridge is then covered with the canvas, the whole being cemented together. The canvas is trimmed closely round the edge of the insole, to which it adheres closely and forms a support to the leather insole. It also reinforces the shoulder or ridge and produces a sewing surface.

Mechanical fastenings that clinch on the inner side must have a leather with a solid grain, and they should have sufficient substance to permit of the upper being tacked on and to carry the clinch. In the absence of substance in the actual leather insole, a backer may be used.

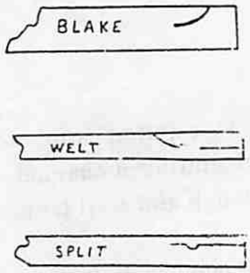
Methods of attachment that depend upon a screw, must be stout and close in the fibre. The materials should be as solid as possible, a loose insole resulting in a screw drawing. In a modified sense the pegged boot should also have an insole of a similar character. Blake sewn insoles may be feathered upon special machines, or the edges may be scoured off upon the "Power Buffer." Where special means are taken to prevent squeaking, or a great deal of solution is used in the bottom, it is an advantage to scour the flesh of the insole.

It does not appear to be generally understood that the grain of the insole is the part which has the greatest stiffness, and that if this grain is cut or buffed away, the insole is much more flexible. It would be an advantage to split off or buff the outer grain of all stock intended for insoles, thus producing the leather similar to that used in Carding machines.

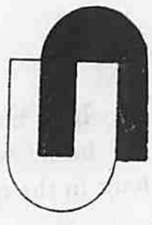
Machine welted work which have entire leather insoles, should have a channel similar to that shewn on Plate 67. This consists of a split edge and an inside groove; generally, the channel is cut

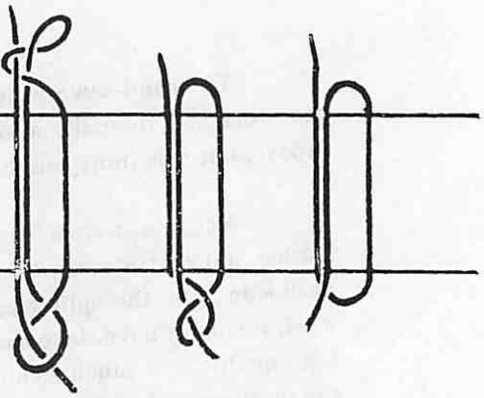
To face Page 144.

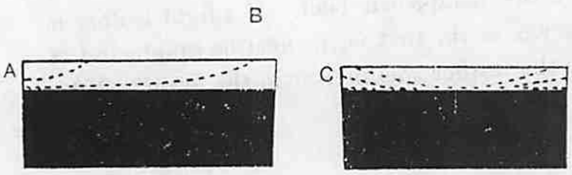
Plate 67.



Channels.


Interlocked Knives.


The Hand Seam.

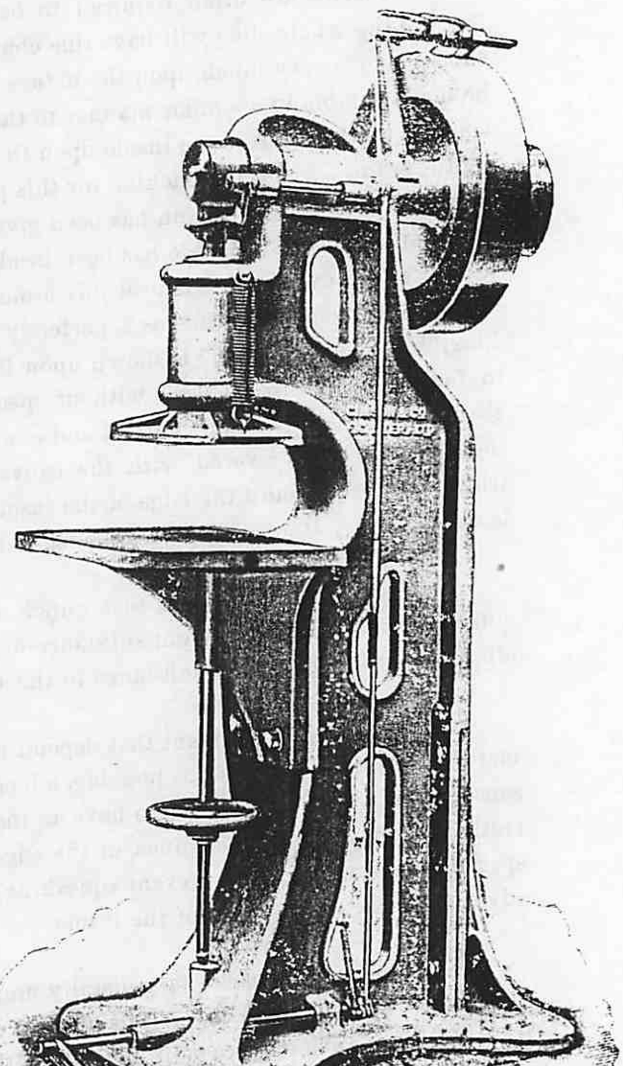


Long Section.

Cross Section.

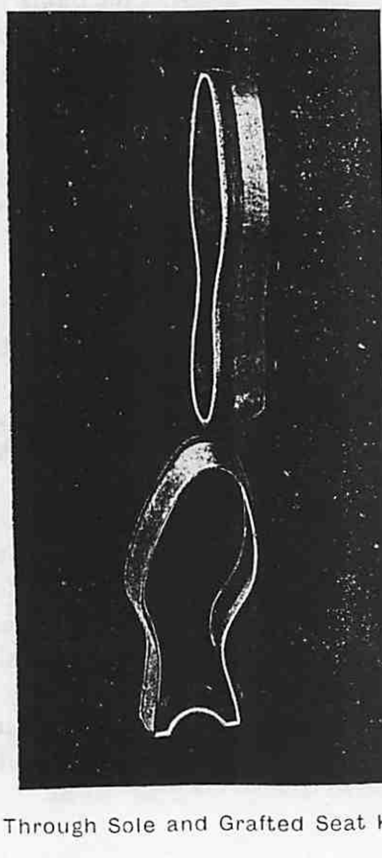
Sections of Heel.

Revolution Press Knife.



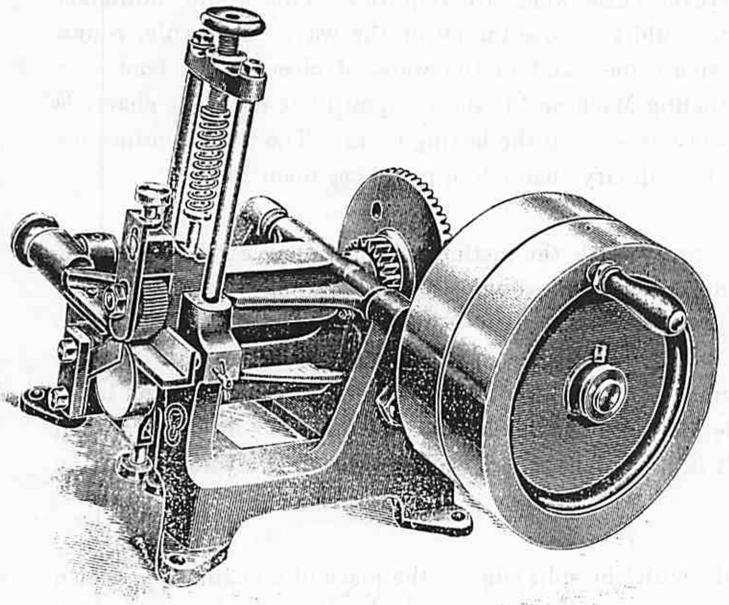
Patent "Climax" Press,

By Messrs. GIMSON & Co.,
LEICESTER.

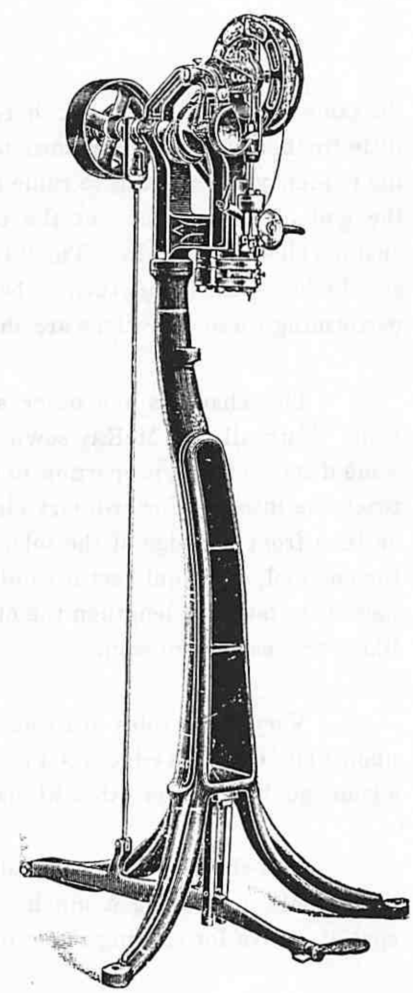

Through Sole and Grafted Seat Knife.

To face Page 145.

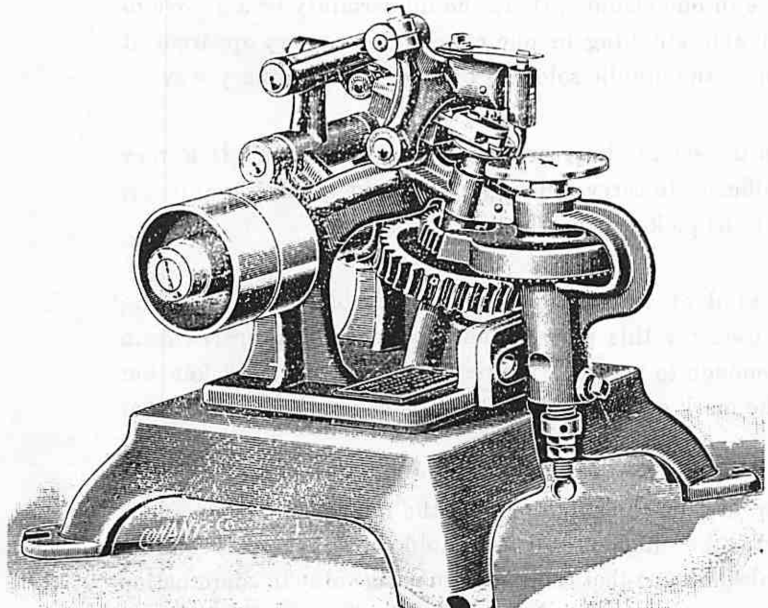
Plate 68.



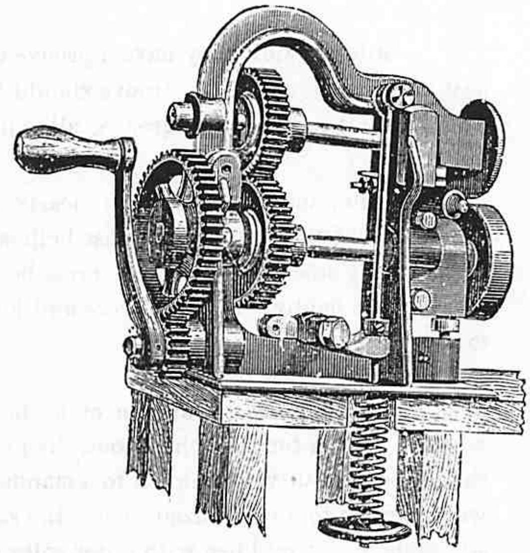
London Rand Splitter.



Wire Grip Tacker.



Lift Trimming (Goodyear).



"Blake" Channeller.

Splitting, Trimming, Channelling, and Tacking Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

(See Plate 69.)

the same depth all round, but there is no doubt that it would be an advantage to set the channel a little further in at all sharp corners, and wherever close welts are required. This would counteract the tendency of the seam to come out, in fact, would get the seam out of the way. As a rule, round the end of narrow toes, at the corner of square toes, and in the waist of close-welted boots, the channel should be set in. The "Insole Channeling Machine" is shewn upon Plate 69. The channels should be opened and turned before the work is sent to the lasting room. The two machines for performing these operations are shewn with the ordinary channeling machines upon Plate 69.

The channels for outer soles vary greatly with the method of attachment and the width of welt. Naturally, in McKay sewn, a very wide welted boot would either have to have the channel set some distance in, in proportion to the welt, or would have a very wide channel, to enable the seam to reach the insole. For ordinary close-welted work, the edge of the channel should be about 1/8th-of-an-inch from the edge of the sole. This would permit the lip of the finishers iron reaching the lip of the channel, and would set it solid. In wide welts, the channel is naturally further in unless special means are taken to lengthen the channel. It is not advisable to make too long a channel, it being likely to weaken the seam.

Very light soles are sometimes made with the split edge in the place of a channel, as shewn upon Plate 67 ; this edge has a groove cut in it to carry the seam. A similar groove might, with advantage, be used for other kinds of channels.

The channel for a stitched boot may be commenced at about 1/16th-of-an-inch from the edge of the sole, producing a much neater finish than is possible with a sewn seam. It has usually a special groove for sinking the stitch.

Where the sewing and stitching is done in one channel, there should certainly be a groove to carry the stitching seam. The advantage of double stitching in one channel is not very apparent, it would probably be better to put an imitation upon the middle sole and to sew in the ordinary way.

Stitched aloft may have a groove cut in the sole, to bury or partly bury, the seam. If a very neat stitch is required, the groove should be sufficient to carry the seam ; if a bold stitch is wanted, it would be put in without a groove, allowing it to be picked upon the sole.

Welts may be cut from nearly any kind of leather that is soft, flexible, and yet firm ; generally, shoulders and high-class bellies are used for this purpose, and are specially prepared from the ordinary stock. The leather must be soft enough to take the impression of the stitch pricker, but must not be flabby. If it will take and hold the mark of the prick stitch, it is generally of a character to sew easily and to wear well.

Middle soles should be of a character to take the stitch or hold the impression of the fudge wheel. If it is for a stitched boot, the grain must be sufficiently firm to hold the stitch. All middles should be carefully split down to a standard substance, so that their edge-making value in combination with soles, is to a recognized scale ; the same principle should be applied to all other parts. It is not advisable to put middles with outer soles of entirely different leather, it being nearly impossible to make a solid edge from two leathers of entirely different character.

Middle soles and outer soles should be moulded in the preparation room, and either attached together by the "Wire Grip Machine," shewn upon Plate 68, or cemented and moulded, as shewn upon Plate 71. The "Economy Cementer" used for this purpose, is a pneumatic cementer for using india-rubber solution. The solution is enclosed in a cast-iron vessel, which is provided with a pump for forcing air into the vessel; a pressure-gauge indicating the pressure. The solution is forced out of the cementer through a brush, by which the cement is spread on the soles, etc.; the quantity of cement used being easily regulated. The cementer is fireproof, and being hermetically sealed, prevents evaporation.

After cementing, the sole and middle may be moulded upon the "Double Sole Moulder," or upon the "Single Machine" shewn upon Plate 72. The "Young Twin Sole Moulder" is made with right and left moulds to suit any lasts. The action is vertical; the pressure being direct and alternating upon the two moulds; therefore, one mould is being fed while the other sole is under pressure. The capacity is about twelve pairs of soles per minute.

The difference between the curve and the bottom of the lasts, and the part to be attached to it, should be made up by special fitted pieces: for instance, it would be an advantage to have a special seat piece cut about the same substance as a welt and fitted round the seats to reach the welt, being grafted in the end of the welt. This would make a better range of seat than simply skiving off the welt and bedding the heel down to it. The edge of this seat piece should be skived on the inner side. It may be skived upon any of the machines about the fitting room; the "London Rand Splitter," Plate 69, would do it very well, or it might be cut out to shape as shewn by diagram on Plate 67.

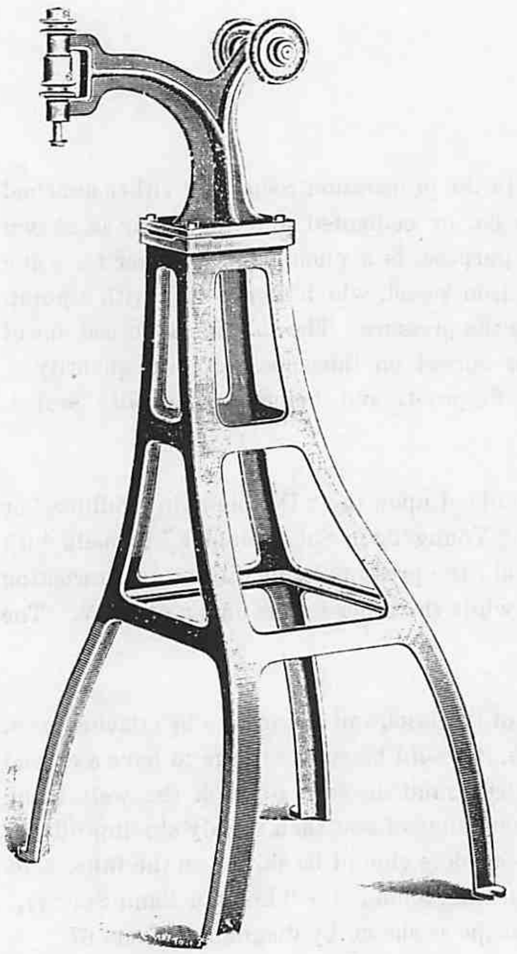
It would also be an advantage to cut a piece out of the seat of the heel—that is, cut a piece as A B, shewn on a section of the heel—Plate 67. This would take the place to a certain extent of a split lift; but it is advisable to put the ordinary split lift between this lift and the next, as C section of heel.

The difference between the curve of the seat and the flat surface produced in building a heel is not generally provided for to the extent required. The heel is expected to be solid upon its outer surface, and therefore this surface should have the greatest amount of pressure put upon it. To secure this, the outer parts should be built higher than the centre, the result being that the pressure being equal, the outer edges would receive the greatest amount and would be, relatively, the most solid. This would naturally cause the edge of the seat to bed up close to the stiffening, and permit the heeling machine to make a closer seat, and nearer to its true shape.

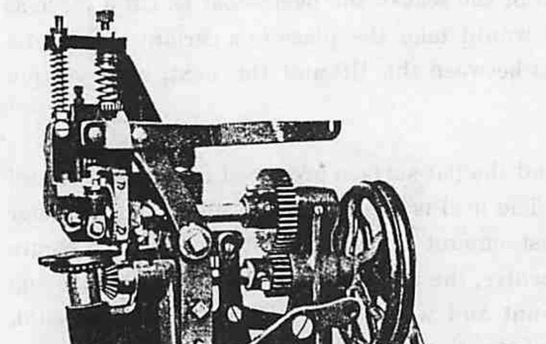
Soles are often skived very carelessly across the joint of the graft,—considerable care should be taken with this matter. The graft piece and the sole should have similar skives, and should be the same upon both sides of the seat. It often happens that the sole and graft are not drawn straight across the skiving machine, resulting in unlevel seats.

Light substances, as toe puffs, etc., may be skived upon the "Amazeen," or new Friction Feed Skiver, which can be used with advantage in skiving the light parts of bottom stock.

The new Friction Feed "Amazeen Skiving Machine" is run from the main shaft by a direct belt, it is fitted with an automatic self-adjusting arrangement to the belt, so that the pulleys adapt

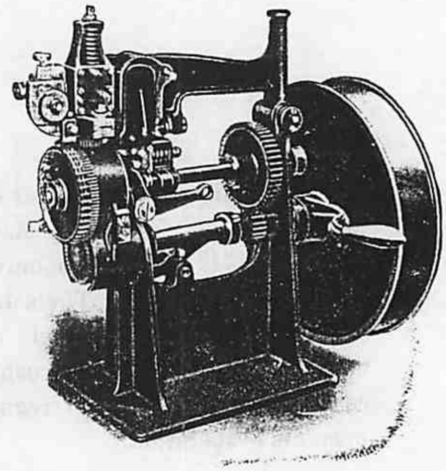


"Goodyear" Channel Opener.

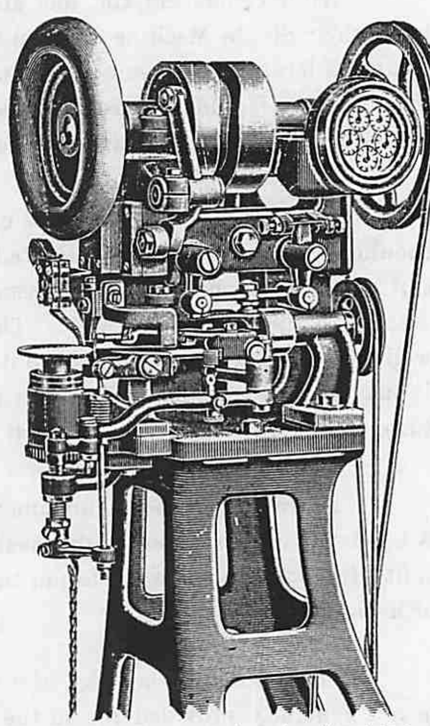


"Goodyear" Channeller

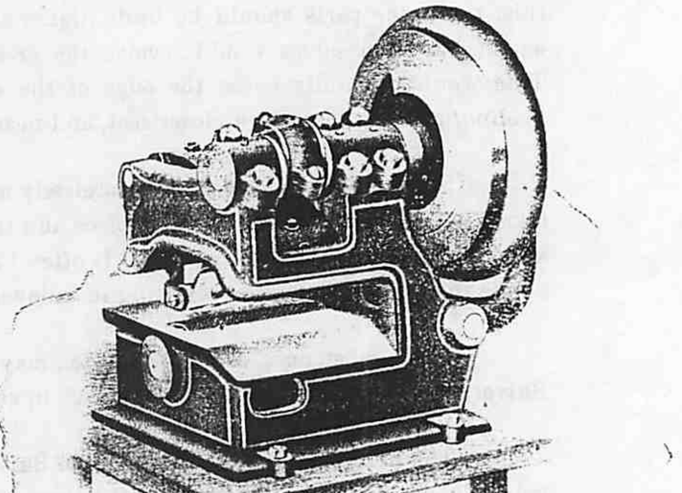
(*See Plate 71.*)



Power Channeller.



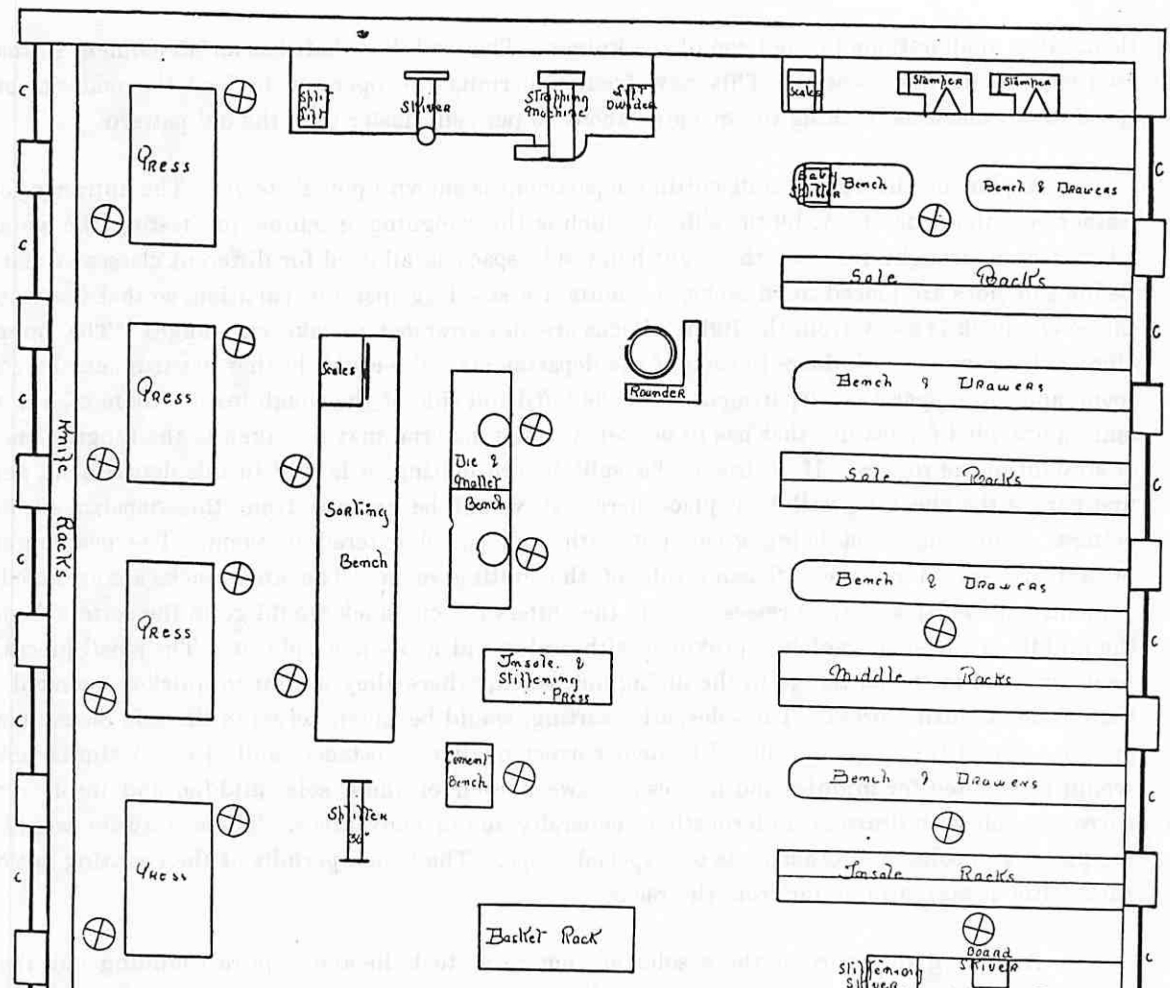
"Gem" Flexible Insole Machine.



Flexible Insole Machine.

BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

Plate 70.



Plan of Rough Stuff and Preparing Room.

themselves to alterations in the level of the knives. The feed disc shaft has an attachment so that the feed moves with the material. This new friction permits the operator to feed the material at full speed of the machine, making the machine about 25 per cent. faster than the old pattern.

A plan of the rough stuff cutting department is shewn upon Plate 70. The entrance for the leather is at the doorway A, by the side of which is the weighing machine for testing the weight of all materials brought in. On the right-hand side space is allowed for different classes of material. Bends and sides are placed upon racks, the butts are stood against the partition, so that the whole of the rough stock is away from the light. Racks are also arranged to take cut ranges. The foreman's office D is provided with doors to each of the departments : the rough leather department, the cutting room, and the preparation department. On the left-hand side of the rough leather room a large water tank is provided for leather that has to be rolled. The material may be taken to the ranging machine or straight to the rollers. If it has to be split before cutting, it is split in this department, and the first part of the checking will take place here. It would be entered from this department to the cutters, a stocking sheet being given out with each parcel entered to them. The position of the presses are shewn on the left-hand side of the cutting room. The knife racks are arranged conveniently at the back of the presses. From the cutters the cut stock would go to the sorters' bench in the middle of the shop, which is provided with scales and a 30-inch splitter. The small pieces after being credited to the cutter, go to the dieing out bench, where they are much quicker operated upon than under a cutting press. The soles, after sorting, would be taken across to the sole racks upon the opposite side of the shop, and placed in their correct quality, substance, and size. A similar method would be adopted for middles and insoles ; between each of these sole, middle, and insole racks, a narrow bench with drawers underneath is generally found convenient. These drawers would take top pieces and soles, and other parts of a special shape. The bench permits of the counting out of the parts without taking them far from the racks.

Assuming that part of these soles are cut to a stock die and require rounding out, the sole rounder may be placed as shewn. The smaller accessory machines are placed upon an end bench—the sole stamper, small scales for weighing lifts, lift divider, rand splitter, skiver, split lift machine and baby splitter ; the latter for the purpose of levelling up any small parts that appeared to be unlevel. A special insole and stiffening press should be provided apart from the other presses ; this will allow of the offal from the sole cutter being entered separately to the insole cutters, and, where the same material is not used, for greater convenience to the insole racks. The insole and stiffening and skiving machines would be arranged near the stiffening racks.

It is advisable to have a basket rack opposite the foreman's office. All work to be entered out of the room should be placed upon this rack and credited to the department.

The cut stock will now go into the preparation department shewn upon the right hand. If the soles were liable to stain, they will now be damped and put away into the dark cupboard to get mellow. The other processes may be seen by inspection of the plan and by the description previously given. The position of the machines would be about in the order shewn, but very much would depend upon the volume of the work, its variety and the method of attachment. This plan represents the machines required for a general trade, and does not include some very special machines which might be utilized in a highly specialised factory. At the same time it includes several machines that are only required where there is considerable variety in the work. If this specialisation was very

high, several of these machines would be thrown out, and a larger number of particular types of machines put in their place. The output provided for is about 5,000 pairs per week; and although the reduction of the number of presses would reduce the possible output of the department, the number of smaller machines could not be reduced proportionally, and consequently a smaller shop producing the same variety of work would have a higher proportionate plant of machinery.

The whole of this stock should be sorted by a method similar to that described on page 93. Assuming that the soles are sorted into five qualities and into seven substances, it is advisable to arrange the qualities alphabetically, and the substances by numbers as previously described. The bays shewn upon the plan, with the racks running at right angles to the windows, are convenient for this arrangement. Each rack should be of about 6½ feet high, divided into compartments about 8 inches wide; each of these compartments should have a sub-division down the centre. By again dividing the height of the rack by 6 or 7, representing the number of sizes in the set, provision would be made for one quality and one substance in each vertical row. By this means a rack 14 feet long would provide for 3 qualities, 7 substances, and any 6 or 7 sizes.

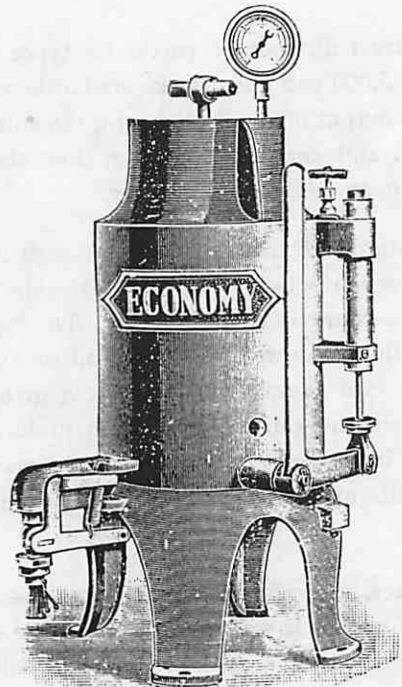
It is advisable to have a special bay for each type of leather, and refer to them by the class of leather in them; for instance, Union C 4, would mean the Union leather bay, quality C, substance 4; other leather to be arranged in a similar manner. This principle should be applied to middle soles and, in a modified way, to insoles also. It is advisable to divide middles into sewn and stitching middles, and insoles into sewn through, welted, and screwed middles. There may be also sub-divisions, as solid leather, backed, veneered, and veneer or composition, or pancake.

We may now assume that the bottom stock is prepared for the lasting and attaching, and that all parts have been moulded and fastened together. The principle explained for checking material in the upper stock room, may be applied in this case. There is no essential difference between the principle of checking or costing bottom stock and that applied to upper leather.

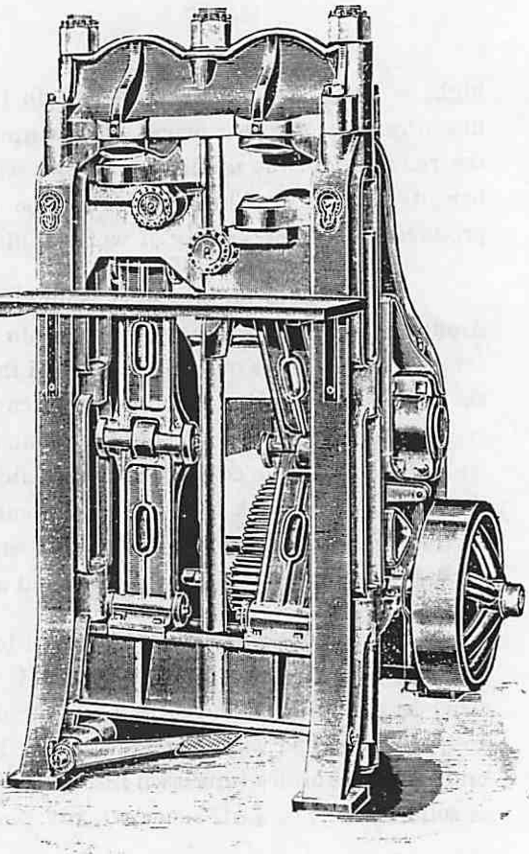
The principles of costing cut stuff are the same as described before, but some examples will probably be desired by the beginner; a simple account of the application of the method of this department is included. If material is cut up into one shape and it is all of the same quality, the cost per piece would be found by dividing the cost of the parcel of material used by the number of pieces cut from it. Naturally, there would be some waste, and the cut stuff would not weigh the same as the material used up; the difference between the weight of the original parcel and the cut stuff would give the weight, and the weight of the latter could be used as the standard of the weight per pair or per piece. If we suppose that a purchase is made, or stuff taken out of stock that is represented by 24 lbs. of bellies at 6d. per lb.; that these being cut into counters produce 145 pairs; that upon these cut counters being weighed they are found to weigh 20 lbs.; we have now the figures sufficient to determine some prices and averages.

	£	s.	d.
DEBIT.			
24 lbs O V Bellies @ 6d.	0	12	0
Produced cut stuff	0	12	1
Profit	0	0	1

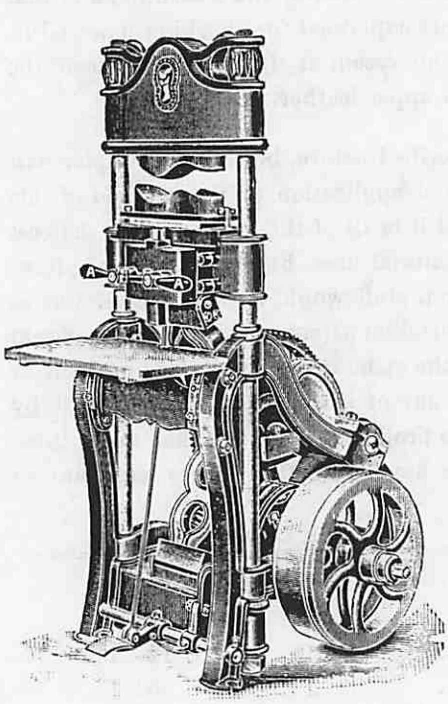
	£	s.	d.		£	s.	d.
CREDIT.							
20 lbs. cut stuff @ 7¼d. ...	0	12	1	= 145 pairs counters @ 1d. ...	0	12	1



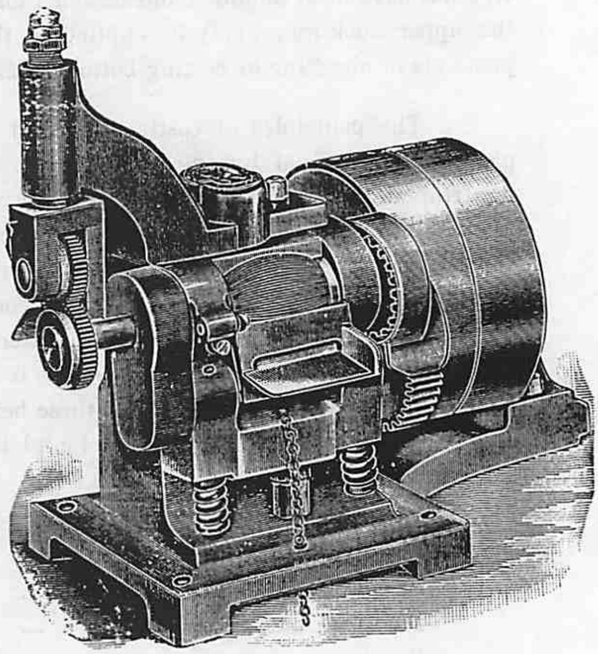
"Economy" Cementer.



Double Sole Moulder.



Single Sole Moulder.



Stiffener Rolling Machine.

Cementing, Moulding, and Rolling Machines, by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

(See Plate 72).

These facts are sufficient to determine the cutting value of the material, the cost of the counters per pair, and the proportion of waste, and the average weight of this class of counters. The 24 lbs. produced 20 lbs. of cut stuff—this gives one-sixth waste ; this then is the amount to be allowed—assuming that the cutter is a man that can be depended on to do justice to the stock. This gives 1 lb. $10\frac{1}{2}$ ozs. for 12 pairs, and 1d. per pair.

If we take another 24 lbs. and test it for insoles, we should get a result something as this :—

DEBIT.

	£	s.	d.
24 lbs. O V Bellies @ 6d.	0	12	0
Produced cut stuff	0	12	0

CREDIT.

	£	s.	d.
20 lbs cut stuff @ $7\frac{1}{4}$d. ... 0 12 0 = 96 pairs insoles @ $1\frac{1}{2}$d. ...	0	12	0

We have the same average of waste, and the other figures do not require explanation ; but we are now in a position to make out a scale in reference to this line of rough bellies.

Description.	Counters.				Insoles.			
	Waste.	Cost per pair.	Weight per dozen. lb.	ozs.	Waste.	Cost per pair.	Weight per dozen. lbs.	ozs.
O V Bellies.	1/6	1d.	1	$10\frac{1}{2}$	1/6	$1\frac{1}{2}$d.	2	8

This gives a record, and may be used as the factors for the compilation of a table giving the standard cost of cut stuff produced from different classes of rough stock. This method may be carried out in other classes of material until a complete reference set of figures is produced.

We have assumed that the parts produced from the material were all of the same quality ; this is seldom the case, and the bulk of the product has to be costed after the value of the oddments have been deducted (see Pages 95-6-7). The application of this principle to the cutting of sole leather may be made as follows :—We will assume that a purchase has been made of 322 lbs. of O V butts @ $1/4\frac{1}{2}$, and that these are cut up into what they are suitable for. We should commence by dividing the oddments and waste from the bulk of the produce, and then sub-divide by taking away and crediting the cost of the material with the value of the parts taken ; this would leave us the cost of the material, less that used for other purposes to be divided into the number of pairs of the parts cut. This may be done in stages.

DEBIT.

	£ s. d.
322 lbs. O V Butts @ 1/4½	21 16 0

CREDIT.

	322
280½ lbs. cut stuff	280½
	41½ waste.

215½ lbs. cut soles.
75 lbs. cut stuff.

We find by this that there is an average of one-seventh waste in the cutting of this material, and that we have 75 lbs. of oddments cut in with the bulk of the soles. This represents about one-quarter of the cut stuff, and should be compared to the product of other materials; the trade being done may permit of this amount being included, but if only a few lines were cut in the factory it might not be an advantage, and the cut-in stuff should be lowered in price.

In any case the value of the odd cut stuff has to be deducted first, and then the remainder divided by the number of the soles produced.

		£	s.	d.
75 lbs. of cut stuff				
	10 lbs. half lifting @ 1d.	0	0	10
	4 lbs. tip filling @ 3d.	0	1	0
	13 lbs. middles @ 9d.	0	9	9
	10 lbs. childs' soles @ 1/4	0	13	4
	28 lbs. top pieces @ 1/8	2	6	8
		£3	11	7

	£	s.	d.
Cost of butts ...	21	16	0
75 lbs. cut stuff ...	3	11	7
	£18	4	5

The value of these different items must be decided by the value to the consumer. If they can be purchased or cut from some other materials at a lower rate than given, they must be valued at that lower rate. Many mistakes are made in this matter; a supposition value is given to the cut-in stuff, higher than its cost from other material, and the cost of the bulk of the cut stuff made too low. Some experience is required, or some figures giving the results of other stockings.

We now start upon the value of the cut soles, and have £18 14s. 5d. to account for. We have 215½ lbs. of soles, which gives an average of 1/8⅓ per lb; if they were all one quality and substance, this would give the cost per lb., and the number of pairs the cost per dozen or per pair. We have 537 pairs, which averages out at 8⅙d. per pair. The figures are :—

DEBIT.

	£	s.	d.
	18	14	5

CREDIT.

	£	s.	d.
$215\frac{1}{2}$ lbs. cut soles @ $1/8\frac{1}{3}$	18	4	$8\frac{3}{4}$
537 pairs cut soles @ $8\frac{1}{6}$d. per pair	18	5	5

This is the simplest solution of the matter; we have these soles which cost $8\frac{1}{6}$d. per pair, and which average 4 lbs. $12\frac{1}{3}$ ozs. per dozen pairs. But soles are rarely all the same quality, although sometimes made to do; we therefore sort them into three qualities, or more, according to the class of leather. The bulk of the soles for which it is assumed the material has been purchased is put on one side, and the known value of the soles cut in with them deducted. We will assume that upon sorting the stuff out, we find that there is 172 best quality, 285 seconds and 80 thirds, and that our stock book shews that the best are worth 9d. per pair to us, and that the thirds are worth 7d. per pair. We now have

	£	s.	d.
172 pairs best soles @ 9d.	6	9	0
80 pairs thirds @ 7d.	2	6	8
	£8	15	8

	£	s.	d.
Total cost of cut soles	18	4	5
Value of best and thirds	8	15	8
	£9	8	9

We have now the figures which determine the cost of the bulk of the soles cut; these amount to 285 pairs, and the figures shew that they have cost 8d. per pair.

	£	s.	d.
Value of soles used	9	8	9
285 pairs @ 8d.	9	10	0

This leaves a profit of 1/3; quite close enough in the present condition of the leather market.

It must be assumed that some figures are already in hand; for instance, the value of the best and thirds in this case is assumed; this is supposed to include some previous stockings from which the figures have been produced. Some manufacturers take the average and add and take off certain amounts. The soles have averaged about $8\frac{1}{6}$d. per pair; some manufacturers would add 1d. for the best and deduct 1d. for the thirds, and would not be far out. But it is dangerous; the rule should be when this latter "rule of thumb" system is used, to only make these allowances when the best are in greater number than the common; the manufacturer then has the advantage of the difference if there is a large sale. If the common is in excess an extra allowance must be made, or a loss will be made on the cutting.

The costing and checking of bottom stock is made somewhat difficult by the wetting and ranging, altering the weight of the material. The best plan to secure accurate costings is to weigh dry and then wet roll, and roll and allow the stuff time to dry out. This should not take more than two days. If a leather takes more than this time it has been loaded, and should be tested for glucose or barytes. Another method is to wet and roll and then weigh out, and indirectly stuff is cut; it is not so uncertain in practice as it appears in theory, but certainly not so accurate as the method described.

The points to be noted are the increase of the weight after being wetted, and the proportion in the different parts, For instance, if 275 lbs. of leather increased 10 lbs. during the wetting, the water in the leather would amount to 1/30; this proportion should be deducted from each of the items to secure the true weight. Some manufacturers do not make these allowances, but simply charge for the leather and the water, and allow the full price on the cut stuff; it works out very well, the loss by evaporation being all in favour of the manufacturer.

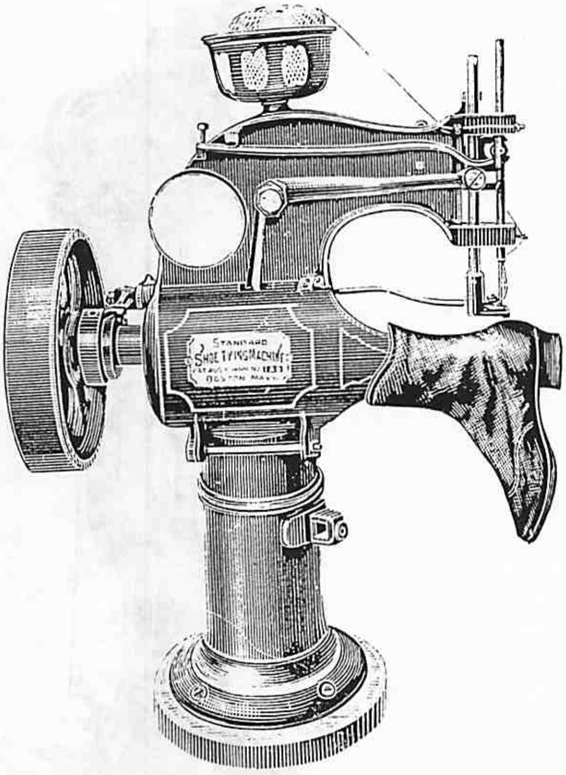
Heel building may be done by hand or machine. Probably the simplest form is by means of a block which is fitted with a vertical gauge, against which the lifts are piled until the correct height is obtained. They are pinned or cemented together. By some methods a large number are cemented to one height, placed upon a tray and subjected to great pressure. Another form of machine consists of a mould in which the lifts are dropped. This mould consists of jaws which are operated upon by means of a foot treadle pressing the pieces together. They are then pinned through ready for the Compressor.

The British United Machinery Company have a complete set of heel building plant. Their Automatic Heel Builder is constructed for two operators, each of whom pass a heel to be built under the head of a tacker. As each of these operatives work in precisely the same manner, a description of the processes executed by one will apply to each of them. The bottom lift with a split lift attached by the "Rand Tacker," is placed with the number of lifts required for the heel. These are put upon a small table which swings from under the tacker head. The side of this surface is fitted with a heel gauge which works upon a pin, so that it may be turned easily towards the operator or conveniently towards the tacker head. The gauge may be fixed to any height to suit the particular heel, the operative builds the heel to this gauge, swings it under the head of the tacker, which immediately drives two or more tacks. The heel plate is then swung towards the operator, who removes the heel and builds another. The action of swinging the plate towards one operator swings the companion plate into position, and by this means the side of the machine is used alternately—Plate 72.

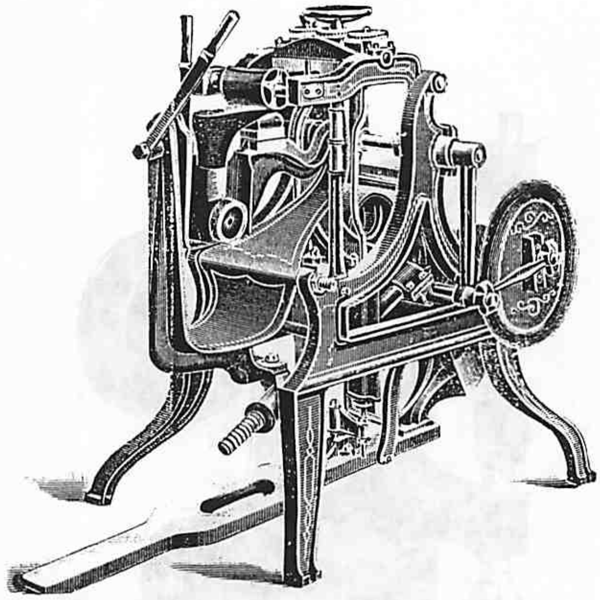
The "No. 4 Heel Compressor" is one of the most rapid machines invented for compressing heels. The built heel is placed within a split jaw and fed forward under the machine and over a mould. The centre of this mould sinks, and a plunger head descends and forces the heel into the mould. While the plunger head holds the heel, the centre of the mould is acted upon by the pressure beneath, compressing the heel against the plunger head. The plunger head then rises and, with the same movement, the centre of the mould rises also. This ejects the heel from the mould and feeds it into a slide. The operator feeds the machine with another heel and repeats the operation. The split jaw which received the heel before being compressed, is arranged to take only one heel at a time. Its capacity is about 6,000 pairs per day.

These heel compressers do something more than their name would indicate. They not only press the heel by some two or three thousand lbs. pressure, but they press up the side producing a solid surface to the heel.

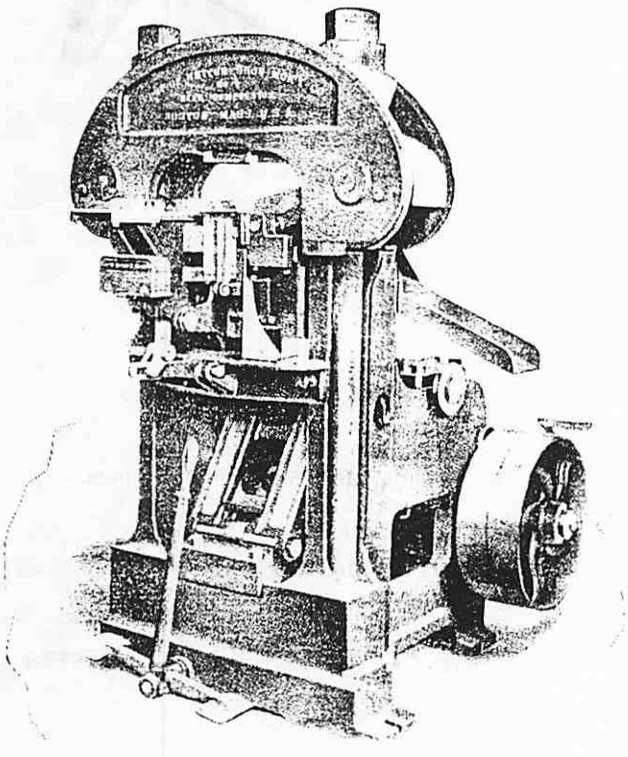
Plate 72.



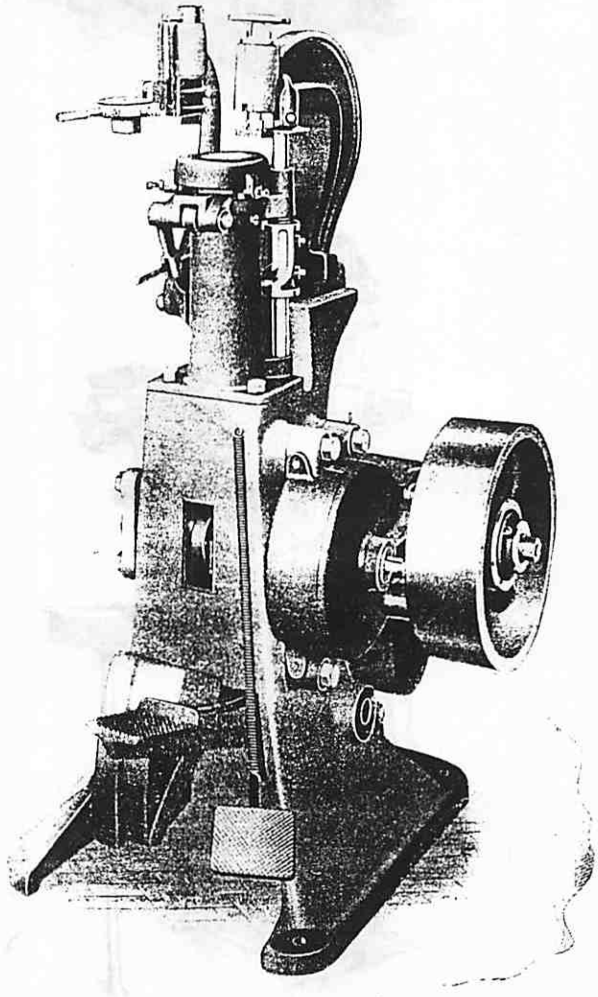
Standard Tying-up Machine.



"Acme" Leveller.



Heel Compressor.

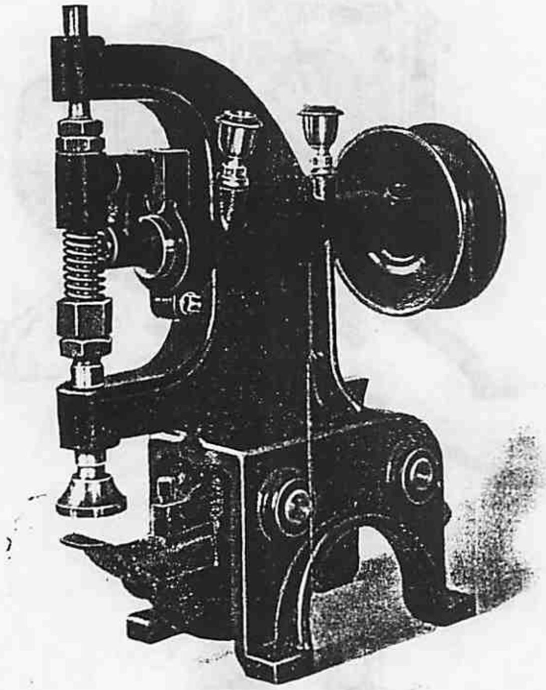


Heel Builder.

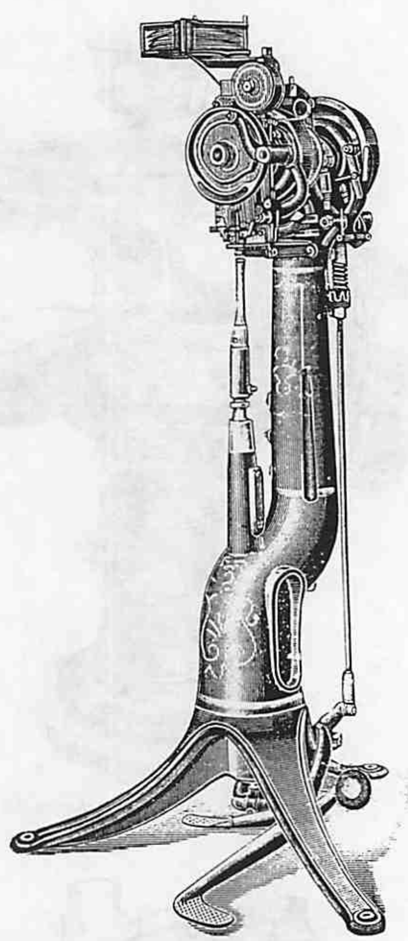
Tying-up, Levelling, Heel Compressing and Building Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

(See Plate 73).

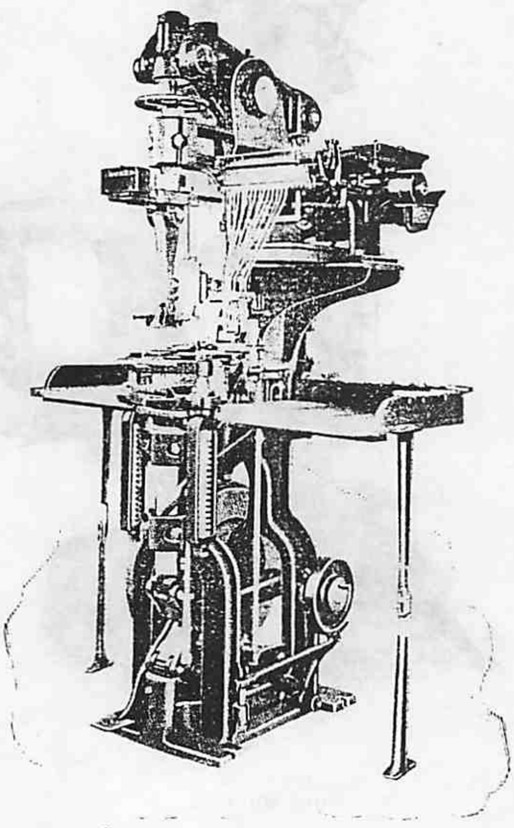
Plate 73.



"Goodyear" Welt Beater.



"Universal" Slugger.



"Mayo" Heeler.

Beating, Heeling, and Slugging Machines,

by

THE BRITISH UNITED MACHINERY Co.,

Union Works,

LEICESTER.

(See Plate 80).

The "Lightning Heel Attacher" is operated by a man and a boy, and attaches the heel and blinds on the top piece. The nails are fed through a metal plate, which swings from the side of the head, and which is fed by a boy at the back of the machine. The plate is swung forward each time a boot is heeled. The nails are driven by a plunger head fitted with a large number of wire plungers, which work through a metal plate and drive the nails. The plunger head then rises, releasing the top lift. A top piece is then placed upon the ends of the upstanding nails; the plunger again descends, attaching the top piece. This machine is one of the most popular machines for automatic heeling, and is used by a large number of shoe manufacturers in England and America.

A much faster machine, with the capacity of about 10,000 pairs per week, is the "Mayo Heeling Machine." This forms another machine in the Company's Heel-making Set. By this machine, the boot is jacked while a boy feeds the nails into a nail plate, and places the top piece in a carrier. The operator places the boot beneath the machine in correct relation to the heel in the heel carrier; the nails being fed from the nail receiver, which returns to the boy for fresh nails. The machine now attaches the heel, and the next movement brings the top piece to the correct position relating to the heel, another movement of the machine blinds the top piece on. The boot is brought forward and taken from the jack. In the meantime the boy has fed the nail plate and the heel stuff, and the machine is ready for the next operation. This is unquestionably the fastest heeling machine on the market. Its capacity is practically only limited by the speed of the man operating it. A moderate estimate would be about 10,000 pairs per week—See Plate 73.

The "Collier's Patent Heel Builder," illustrated on Plate 74, is fitted with a bed, in the centre of which is a metal plunger or form, for the purpose of holding the heel while the nails are being driven by a vertical plunger beneath the bed of the machine. On the top of the bed a groove is fitted to allow a mould to slide for the purpose of feeding. This mould slides accurately over perforations made to take the nails. Each mould is made the correct shape of the heel. The action of the machine is very simple, the operator draws the mould towards him when the last heel made is ejected from the mould by a small vertical plunger which rises beneath the heel and lifts it from contact with the mould. The operator then builds his heel within the mould, and feeds the perforations on the bed of the machine with the nails. He then slides the mould forward, and upon placing his foot on the treadle, the bed of the machine and the plunger descend upon the built heel. By the same movement of the cams beneath the machine, the nails are forced upward by the nailing plungers, the mould is then released by the bed rising, is drawn forward by the operator, the heel is released by the rejecter and the operation is repeated.

The "Patent Heel Compresser" is a perfectly automatic machine. The heels are built by the machine previously described, are fed into a hopper, and are carried forward by a slide beneath the main plunger. Upon this descending, the heel receives the pressure and another heel is automatically fed into position for the next movement. The main pressure plunger having compressed the heel, rises, and the heel is fed forward into a slide, by the same action the next heel is placed under the presser plunger. The pressure is again repeated upon this fresh heel, and the first heel is fed down the slide into a basket or box beneath. This is a perfectly automatic machine which requires no attention except feeding it through the hopper. The pressure is a positive pressure, and produces heels of a uniform height. It is indifferent as to what class of leather is used for the heel, and providing moderate care is taken in putting the right amount, an absolutely correct height in heel is secured.

The "Patent Heel Attacher" which completes the set of heeling machines produced by the the Northampton Machinery Company, has a capacity of 750 to 1,000 pairs per day. The peculiarity of the machine is that the special pins used are driven home to the last, but in no case can be driven beyond. This class of heeling has been approved by the Government Inspector. The machine is fitted with a plunger head which drives the attaching nails, and also attaches the top piece. The nails are fed into a nail carrier which acts along a slide. This carrier is perforated so that it will take any form or shape of nailing, or any number of nails. Upon this carrier being pushed forward, it feeds through an under plate beneath the slide. The operator in the meantime has jacked the boot upon the special jack attached to the bed of the machine, and has arranged the heel in its proper place. A perforated bar comes down and holds the heel. This is the position of the boot when the nail carrier reaches the plate. The nails are now fed into the plunger bar, and the boy draws the slide back, the operator then brings down the plunger bed and attaches the heel. By another movement he releases the top of the heel, places the top-piece in position, the plunger again descends, and the top-piece is attached by the end of the nails left standing about the top lift. This machine requires one man and one boy. The speed is about 400 revolutions per minute, with a 12 inch pulley.

The main feature which is claimed for the "Gimson New Automatic Pressure Heel-making and Heel-attaching Machines"—Plate 75, is grasping the pressure bar frictionately (after it has adjusted itself to the height of the heel) with sufficient force to give the weight desired to solidify, or attach heels. This is effected by the construction of levers in conjunction with toggles and blocks shaped to fit one half of the pressure plunger. The action of the arrangement is as follows :—The machine head carrying the vertical plunger and gripping device is caused to descend, and when the lower end of the plunger meets the heel, the plunger is finished up through the bearings during the latter portion of the downward movement of the head ; then the two levers are forced forward by two cams or wedges, which cause the toggles to be driven against the hollowed-out blocks, and so grasp the pressure bar with great power for making heels, or less pressure for attaching.

The whole arrangement is of the simplest character, and provision is made to take up any wear, so that each heel receives the same amount of pressure.

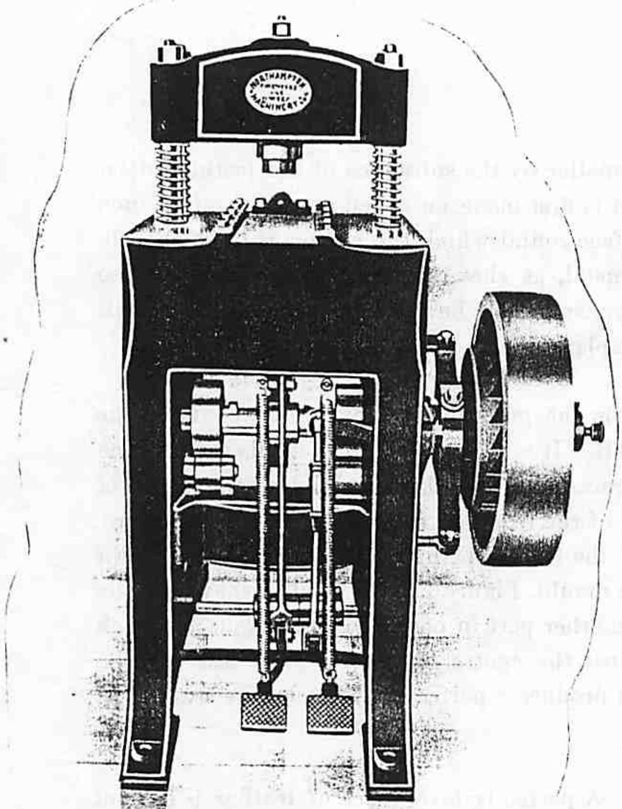
The automatic pressure being under control, it is quite easy to arrange the machine to attach wood heels or the longest leather heels for men's strong boots. The pressure given by these machines is a dead pressure up to the point the arrangement has been adjusted to, so that a breakage is impossible with ordinary care.

This Compresser is fitted with Automatic Feed for receiving the heels and delivering them after compression. The Heel Attaches are fitted with revolvable attaching posts, so that one post may be filled with nails whilst the other is attaching a heel.

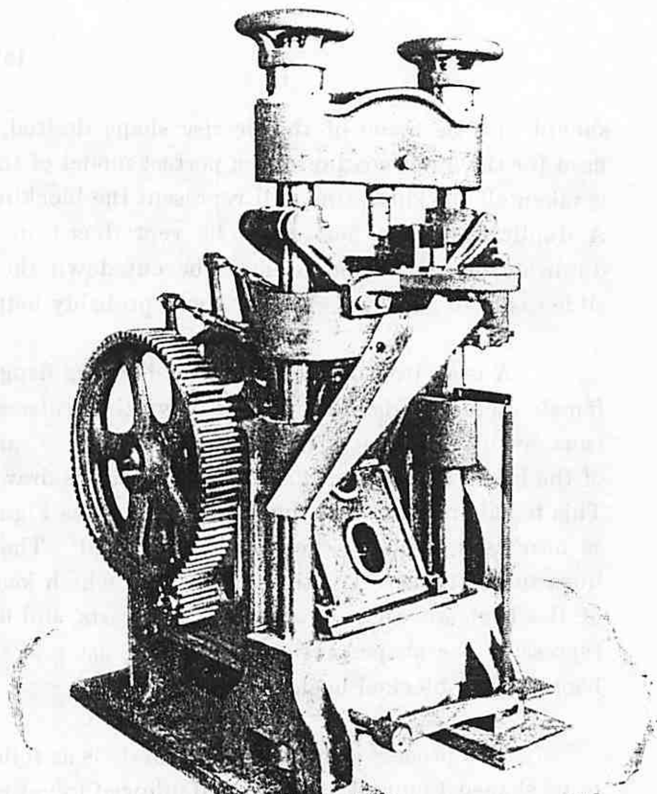
As no time is lost in adjusting the pressure, a greater number of heels can be attached in a given time than is possible by any other process, and the operator has both hands free to manipulate the work.

The solid leather-cased heels with composition filling, and of (Plate 76) the form shewn upon Figure 1 and of the sectional shape as Figure 2, may be blocked in a mould from butt leather or from any good solid stock, at a cost little in excess of the ordinary heel. A model of the heel

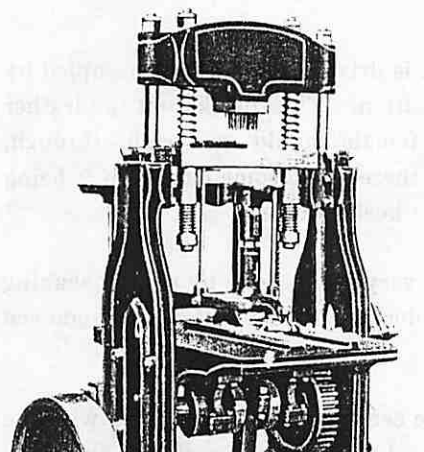
Plate 74.



Heel Builder.



Heel Compressor.



Heel Attacher.

Trimmer.

By THE NORTHAMPTON MACHINERY Co.,
Cleveland Road, NORTHAMPTON.

should first be made of the precise shape desired, but smaller by the substance of the leather to be used for the outer coating. If a perfect model of the heel is first made, and then an eighth-of-an-inch is taken off the sides, this will represent the blocking surface round which the leather is to be shaped. A duplicate of the heel must be reproduced in gun-metal, as shewn at Figure 3. This reverse duplicate or female mould must be cut down the centre, and must be fitted in a box so that it will slide easily in and out. Figure 3 will probably help to explain this.

A is an iron box with an over-hanging flange ; B is the gun-metal block which contains the female mould ; this block is split down the centre as B B B. It will be observed that this section line runs down the centre of the front of the heel, as can be traced upon the drawing, and up the centre of of the back ; consequently, when the block is drawn out of the iron box it separates down the centre. This female mould takes the leather cut out as Figure 4 ; the leather being arranged round the mould as near as possible to the position required. The male mould, Figure 2, is divided as shewn by the lines and sections. A is the centre block which keeps the other part in position. The front and back of the heel are each divided into two parts, and fit against the centre block A. The seat block 5 represents the shape of the seat of the last, and should produce a perfect fit between the seat of the boot and the blocked heel.

The process of making these heels is as follows :—A perfectly level piece of leather is cut out to be shaped Figure 4, damped and allowed to get mellow, the female block is then placed in the case A, and the leather put into position, so that the points BC meet up the front of the heel, and the points A are at the sides. The four sections of the male block are placed in position of the heel inside, the leather being pressed as near as possible into their relative positions. The lower end of the key piece A, Figure 2, is then placed in the centre of the other pieces, and the whole of it is placed underneath the press.

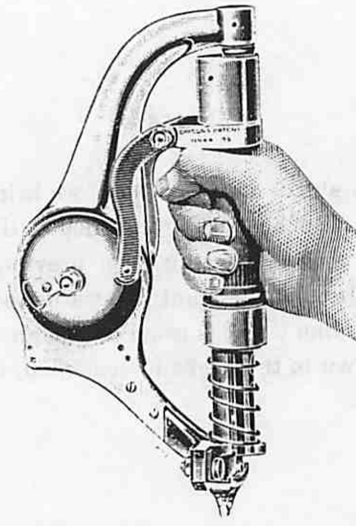
Upon the pressure being applied to the centre key piece, it is driven into position occupied by it in Figure 2. The other parts also having relatively the same position. This blocks out the leather case into the shape of the heel. Seeing that the apparatus of the female mould goes right through, and that the leather case cannot also touch the bottom without there being some danger of it being unduly crushed, the mould should be made a little deeper than the heel required.

The block case is now removed from the mould. This is very easily done by simply shaking the centre block B out of the case A, it then falls apart, and the blocked leather case can be removed and placed on one side to dry.

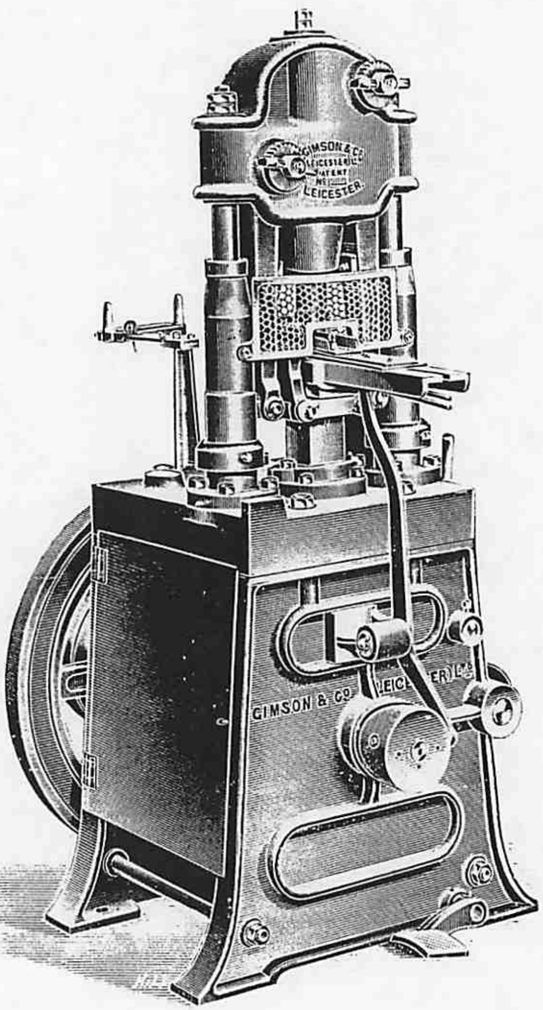
After the case is dry it is replaced in the mould, and the centre of the case is filled with the composition, consisting of sawdust and guttapercha, or sawdust and dexterine, or cork and any gluelike substance. It is advisable to have a centre solid piece shaped much as the key piece A, Figure 2. This may be applied by forcing it into the composition, when the composition is first placed in the leather case. The block 5 is placed over the aperture representing the seat of the last, and pressed down preferably under a small hand press. This will produce the shape of the seat and force the centre block into position. The heel should now be allowed to dry and it is ready for trimming. This trimming consists of paring away the rough edges round the seat A A A, Figure 4, and cutting away the bottom part to the height of the heel required. The relative position of the heel and the bottom of the last is shewn at Figure 1 ; A B represents the position of the attachment between the

sole and the insole ; B C D is the shape of the sole before being bedded down to the heel ; E the sectional shape of the top piece. The heel being attached to the sole from F to G and cemented up the front and along the bottom, the sole having been previously skived, cut the shape shewn at Figure 6 and cement ; it is first pressed at the point E towards the waist, and then pushed up until it is attached at point C. Across the line C C it is usual to plough a piece out and to skive the part C D very thin. This being pressed down to the heel and cemented, the top piece is now placed against it and pin-pointed through.

Plate 75.



Hand Tacker.

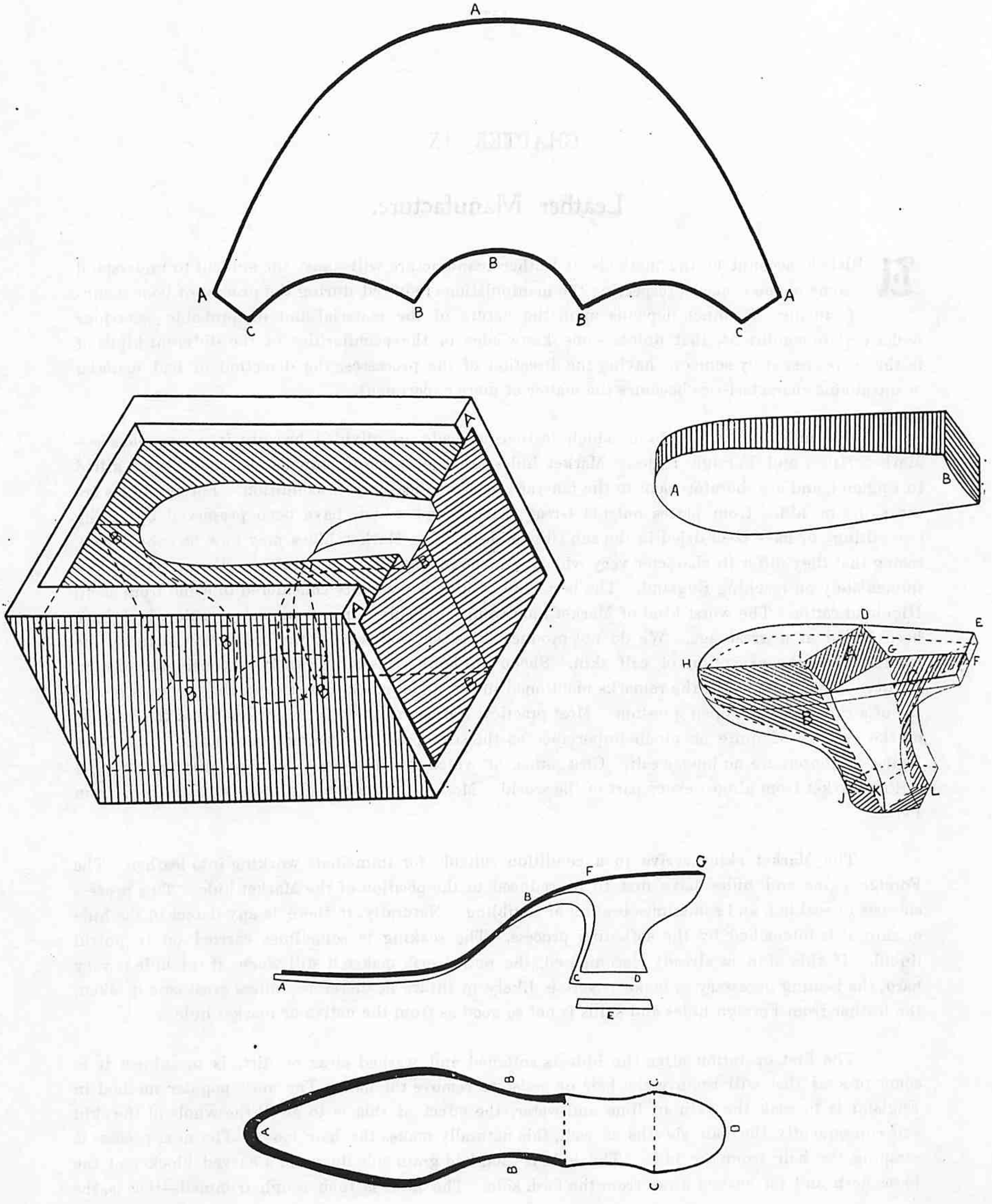


Automatic Heel Compressor.

Heel Making and Lasting Machinery, by
Messrs. GIMSON & Co., LEICESTER.

(See Plate 93).

Plate 76.



The Making of Leather Cased Heels.

CHAPTER IX.

Leather Manufacture.

A BRIEF account of the methods of leather manufacture will assist the student to understand some of the remarks respecting the manipulations required during the process of boot manufacturing. So much depends upon the nature of the material and its probable behaviour under certain conditions, that unless some knowledge of the peculiarities of the different kinds of leather is possessed by someone having the direction of the processes, the detection of bad material or unsuitable characteristics becomes the matter of mere experiment.

The hides and skins from which leather is made are divided broadly into two classes—Market Hides and Foreign Hides. Market hides are the skins of animals that have been killed in England, and are therefore sent to the tan-yard in a practically fresh condition. Foreign hides are the skins or hides from places outside Great Britain, and which have been preserved by salting (wetsalting), or have been dried in the sun (flint hides). The Market hides may now be sub-divided, seeing that they differ in character very widely, and large quantities of foreign cattle are slaughtered immediately on reaching England. The best kind of hide is generally considered to come from small Highland cattle. The worst kind of Market hide would probably come from dairy cattle which have been killed at a great age. We do not produce skins that are used for the production of light, fine leather, with the exception of calf skin. Sheep and lamb skins can scarcely be considered of high quality. As mentioned in the remarks mentioned in the upper stock department, the precise size and age of a calf skin is an open question. Most practical leather manufacturers consider that the fineness of the skin is of quite as much importance as the size or age, but we may take it that skins above 30 lbs. per dozen are no longer calf. Goat skins, of which we now use a large quantity, are brought to this market from almost every part of the world. Most of our supply comes from India or from Persia.

The Market skins arrive in a condition suitable for immediate working into leather. The Foreign skins and hides have first to be reduced to the position of the Market hide. This process consists of soaking, and sometimes beating or tumbling. Naturally, if there is any defect in the hide or skin, it is intensified by the softening process. The soaking is sometimes carried on in putrid liquid. If this skin is already decomposed, the putrid soak makes it still worse, if the hide is very hard, the beating necessary to make it soft is likely to injure it, therefore, unless great care is taken, the leather from Foreign hides and skins is not so good as from the native or market hide.

The first operation after the hide is softened and washed clear of dirt, is to subject it to some process that will remove the hair or assist to remove the hair. The most popular method in England is to soak the skin in lime and water, the effect of this is to swell the whole of the skin and consequently the hair sheaths as well, this naturally makes the hair loose. The next process is scraping the hair from the hide. The hide is then laid grain side down on a curved block and the loose flesh and fat shaved away from the flesh side. The hide is then rough trimmed—that is, the

odd pieces that are not suitable for leather are taken away, and the skin clean upon the flesh side with the waste pieces taken off and free from hair, is ready for actual tanning ; it is now called a pelt.

The shape of the different parts of the pelt and the trimming have been described on pages 132, 133. It is usual to fold the pelt down the centre when cutting it into various parts, and to cut through both sides at once. If this is done carefully, both sides of the pelt are precisely alike, as a well-trimmed pelt or butt should be.

Animal skin which is used for the production of leather, does not differ from human skin, and therefore the remarks made respecting the skin of the foot referred to the skins used for the production of leather. In fact when human skin is tanned into leather it is very similar to fine goat skin. The skin as explained before, consists practically of three distinct parts, an inner skin next to the flesh, in which the fibres are interlaced in the same direction as the outer surface of the body ; this interlacing forms what we referred to as the flesh of the leather. On the outer side of this the fibres appear to take a position vertical with the surface of the body, this produces the interlaced fibres, which contain most of the extractive of the tanning agent. Upon the outer side of this, the fibres appear to become smaller, closer interwoven and to lose their tensible strength. This portion is referred to as the grain of the leather. Upon the outer side of this grain the scarf or scurf skin is situated before the tanning operation, but this is removed before the processes of leather manufacture. The hair sheaths which contain the hair are portions of this outer scarf skin, and when the hair is scraped off after liming, these sheaths are scraped out with it.

The peculiar nature of hair, wool and bristle sheaths have some effect on the appearance of the skin ; the hair sheath appears to be somewhat finer than that carrying the wool. The bristle sheath appears to go much farther into the body of the skin, so that after finishing, the holes left by the bristles can be quite easily found in pig skins, indeed, forms one of the methods of identification.

Putting the description of the tanning operation in the simplest way, it may be stated that the pelt consists practically of gelatine, and that the usual vegetable tanning agents contain a substance which has the power of combining with the gelatine and forming an entirely different material. The substance is an acid of a somewhat peculiar character, broadly it is referred to tannic acid, although there are several different kinds of acids grouped under this general expression. Gelatine if exposed to air becomes putrid, and decomposes into a liquid and some fibres. The tannic acid arrests this decomposition, and renders the gelatine no longer capable of becoming putrid. It also makes each one of the fibres impervious to water ; this effect is practically the whole of the action of the tannic acid, although there is naturally some increase of weight with the combination of the tannic acid and gelatine, and the deposits of some free acid on the fibres of the pelt. The total result of this is to produce a whitish, tough, soft, porous material from the pelt, which will not putrify but which is certainly not leather.

The vegetable agent in addition to the tannic acid has a large quantity of dust-like matter, or matter which can be converted into dust, and which is of a character and colour peculiar to each agent. This is generally referred to, or will be referred to for our purpose, as the extractive of the agent. This extractive is, or should be deposited within the fibres of the hide or pelt during the process of tanning, giving it character, colour and weight. We therefore see that the process of tanning includes two distinct operations—the preserving of the fibres of the pelt by the tannic acid, and the packing of the spaces between the fibres with the extractive.

Seeing that the tannic acid immediately converts the gelatine into another substance (tanno-gelatine), it must be evident that if we place a pelt in a strong solution of tannic acid, the outer surface of that pelt will immediately become impervious to the liquid, and consequently, although the outer surface becomes leather, the inner surface remains raw hide. Badly tanned leather can be detected by this. The cut section shews the colour of the tanning agent upon the outer surface, but the centre consists of a strip of horny material ; this is generally referred to as a green strip.

It is therefore necessary to first soak the pelt in a very weak solution of tannic acid, and then to gradually increase the strength and, at the same time, increase the amount of extractive. By this means the pelt is gradually preserved and fed until the whole of the fibres are filled in with the tanning material. Naturally, the nature of the matter which fills in the fibres gives the leather character and colour and relatively weight.

Although many rapid methods of tanning have been devised, no thoroughly efficient substitute has been found for the process briefly described above, but there are considerable variations in the method of graduating the strength of the liquids and the time occupied by the pelt in each strength. The different divisions are generally divided into suspender pits, handler pits, and layer pits. The method of treatment in each of these pits is represented by their title. The pelt is punched at each corner of the shoulder, and the corners tied to a pole. These poles are laid across the pits much as shewn in the plan of a tan-yard on Figure 1, Plate 66. This first suspender pit contains very weak liquid from the other pits, and has only sufficient strength to prevent the pelt decomposing. The pelt is next moved to a stronger pit, and this removal is continued to other pits for about two weeks. By this time the pelt is coloured and sufficiently acted upon by the acid to ensure it not going putrid. They are then removed to the handler pits. In these pits the pelts are thrown somewhat loosely in and allowed to remain for one or two days, they are then handled out into the next pit where they are subjected to a stronger liquid—See Plate 66. They are moved to increased strength of handler pits for about three or four weeks, and are then put into the layer pits. The layer pits represent the final process in the feeding of the leather, and although there are many deviations in practice the principal is practically the same. A layer of the tanning agent is placed upon the bottom of the pit, and the pelt placed flat upon it. A coating of the tanning agent is then dusted over the top and another pelt placed upon that layer. This is continued until the pit is nearly full, when about six inches of the tanning agent is placed upon the top. This top layer is generally referred to as the hat.

Some tanners do not add any liquid to these layer pits, they consider that the liquid contained by the pelt will provide sufficient moisture for the feeding. Other tanners add a solution of strong tanning agent, which quickens the process and probably adds weight ; naturally, the colour of the tanning agent in the last pits has a great effect in giving the colour to the outer surface of the leather. By this means it is possible to use a comparatively low-class tannage during the earlier stages, but to give a special colour to the leather by treatment in the last layer pits.

The different tanning agents have distinct colours, and if used by themselves, produce leather of distinct character. They are very rarely used quite by themselves, but the following table may assist in identifying the various tannages.

Agent.	*Colour.*	*Relative Weight.*	*Character.*
Oak Bark	Fawn	75 ...	Tough, Mellow.
Mimosa	Pink	80 ...	Soft.
Oak and Valonia ...	Light Brown ...	85 ...	Hard and Mellow.
Mixed Tannage ...	Brown	90 ...	Hard and Brittle.
Hemlock	Red	100 ...	Hard and Dense.

Extracts are produced from several of these agents, and are used to give certain characters to the tannings. It is quite common to refer to tannage that has consisted of applications of valonia and extracts of oak bark as having been an oak bark tannage. But it may be taken that although the use of extractives is excusable, it does not quite produce the same result as the pure oak bark.

All tannages produced from single tannages are of one colour right through, wherever there has been any alteration in the tannage for producing a certain colour, it generally results in the centre fibres of the leather being a different colour to the flesh and the grain.

All good class leathers are regular in their colour and quite clear from any added matter. The flesh side should be quite clear from all loose pieces, and from any colouring matter that has the appearance of chalk. It is quite common for tanners to size the flesh side of their leather. This is excusable for the sake of the finish, but this size should not contain any chalk-like matter that would add weight. After the actual tanning operation the grain of the leather is set up, it is rolled, wetted, allowed to sam, and then rolled between heavy rollers ; a little fat or oil is put over the grain side and the leather is considered finished.

There is considerable difference required between the tanning of a skin or pelt for bottom stock, and for leather intended for currying. The bottom stock should be well filled in, the spaces between the fibres being packed with the extractive. Upon cutting across the section of the leather, the fibres should glisten, at the same time the leather should cut mildly, having a sort of cheesy feel to the knife. Leather that is intended to be curried should not be tanned so much or filled in so much as that intended for bottom stock, the currier will add some method in the shape of curriers' grease. If the fibres are already filled, the addition of the grease produces a very stiff leather quite unsuitable for upper stock. This happens very often in the case of stout waxed hides, they are sometimes overtanned, and after currying appear too stiff.

The part of the pelt intended for sole leather requires to have a rather different tanning for that intended for that of the upper parts. It is not desirable that insoles and stiffenings should have the same character as sole leather. The method of tanning the parts representing the offal is therefore modified, and a combination tannage is used which produces the desired result in the offal, but which would not be strong enough for tanning sole leather. Generally, the soft tannages are of a yellowish tinge, the hard tannages are reds or browns. The browns are commonly modified in colour by use of an agent that naturally produces a yellow tannage. For instance, valonia, which if used by itself will produce a very dark brown leather, is used with myrobalans, which if used alone would produce a soft, brittle tannange, very likely to become discoloured at the edges. This discolouring at the edges of the leather is one of the indications of a low-typed leather, although some very good leathers are liable to become discoloured.

All leathers that are sold by weight have more or less some added matter, although some of it is no disadvantage ; but some leathers are artificially and unduly weighted for the purpose of giving a spurious value. Commonly, this is done by the means of either gluecose or some mineral, generally a combination of barium. There are some very simple methods by which adulteration may be detected. Glucose has a great affinity for water, and leather weighted with it dries very slowly. If two specimens, one that is known to be a good tannage, and the other from the suspected material, are both soaked together in water for an hour or two, and then put away in a dark, cool place to dry, the length

of time taken by each to dry will be a good indication of whether the glucose has been added. If in addition to this, two samples from each of the specimens are placed together, it will be found that the good leather will dry out clean ; but the glucose-weighted leather will be stained on the surface of contact, and if this stuffing is excessive some sticky substance will come out on the surface. Other kinds of weighting may be detected by a similar method, a specimen of good leather should be weighed with a specimen of suspected leather, both the pieces being the same size. These two specimens should be then thoroughly soaked in water, say for five or six hours ; they should then be kneaded about and left to soak for another three hours, and again worked and kneaded to extract as much colouring matter and other soluble matter as possible. After about twenty-four hours' soaking and occasional kneadings, the two specimens should be taken out and thoroughly dried. Upon again comparing the weights, the relative loss during the soakings can be determined, and any excessive loss detected in the suspected sample.

Professor Procter, of Leeds, advises the use of dilute sulphuric acid in the liquid, which will cause a white sediment to form in the presence of barium chloride. The addition of a drop or two of strong solution of chloride of barium will give a white precipitate of Epsom Salts.

A rough and ready test is by the amount of colouring matter, dirt and chalk, which comes out of the leather in the water tank, and how long it takes to dry or sam, ready for the roller. Really good leather dries very rapidly, bad leather always slowly.

Most bottom leather is produced by this vegetable tanning process, and is used wherever stiff leather is required for really hard wear, but some of the stock is now tanned by a mineral tannage, in which chromates take the largest share, these are referred to as chrome tannages. The principle upon which this is produced is, that cromium compounds combine with gelatine to form a substance impervious to water. This takes place in the presence of light or an acid. This is generally carried out in what is known as a two-bath process. The first bath consists of bichromate of potash and hydrocloric acid. The effect of this is, that the chrome is reduced on the fibres of the skin. The skin is now removed to a second bath which consisted of a solution of hypo soda and hydrocloric acid. The effect of this is to reduce the sulphur in the hypo on to the fibres of the skin. This produces a very close fine-grain leather, suitable for the uppers of shoes, but which attempts have been made to imitate by combination tannages.

A class of leather is produced by first tanning with a vegetable agent and then subjecting it to a chrome bath, which gives it the colour but not entirely the character of chrome leather. A simple method of detecting imitation chrome is to cut a fine strip, burn it with a match over a sheet of white paper, put all the ash carefully in the white paper and crush it between the fingers while still in the paper. If it is a chrome tannage a green stain will be found upon the paper produced by the ignited chromium which is green.

CHAPTER X.

Lasting by Hand and Machine.

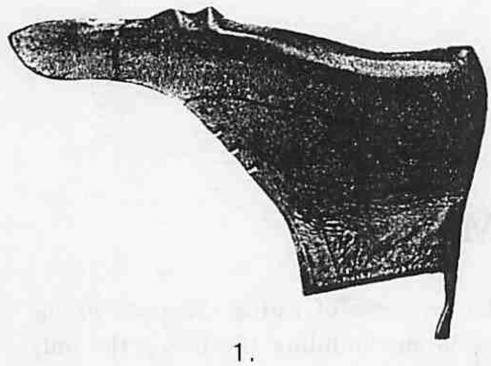
THE term lasting included up to a few years ago all the processes of fitting the parts of the bottom, tacking the upper over the insole, laying the sole and building the heel ; the only preparation being the cutting out of the different parts. These different processes are now carried out by different operatives, and in some cases in different departments. The laster of to-day is simply expected to temporarily attach the upper to the insole, preparatory to the attachment of the other parts.

The operation of lasting, however, is not by any means simple, and it requires either a high order of skill by the hand worker or very beautifully designed movements in a machine. The commonly accepted idea, that if an upper is drawn strongly over an edge of the last and tacked down to the insole the result will be the production of a lasted boot, is altogether wrong. The laster has several natural difficulties to contend with. The nature of the leather used in the upper of the shoes is not constant, either in substance, elasticity, or stretch, and consequently there has to be a variation in the power exerted in merely pulling over the upper. Another point is that the parts of the top are cut out of a flat substance, and the top itself is normally flat. This flat surface has to be strained into the shape of the curves of the last, and seeing that these curves vary in their prominence in relation to the upper, the strains have to be taken along the line of the depression. To merely draw the upper over the last would result in it not being lasted down. The highest points of the last would take the surface of the upper and would strain it above the surface of the lowest curve, consequently it would not be lasted. This is really the explanation of the necessity for taking draft strains. These strains are taken at points that draw the upper along the lowest curves of the last, or the curves of depressions. If this is done accurately, the strain along these depressions is equal to the strain over the eminences, and results in the shoe retaining its shape, or the shape of its curve after the last is withdrawn.

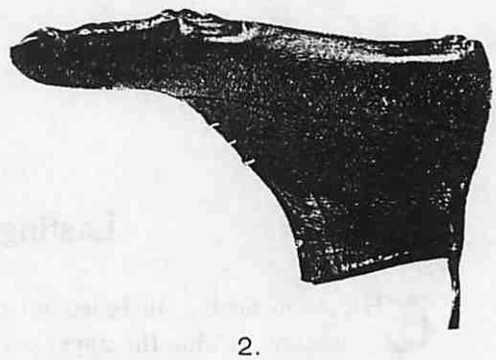
Another matter which is sometimes not taken into account is, that in cutting up material to economise, some of the parts have to be cut to a shape that does not include the true line length of the last, and consequently the laster has to strain out the short line lengths and has to pleat away the excess of measurement. This is particularly noticeable in men's golosh work, where the vamp and the side golosh are cut in one piece. These are usually cut so that the back golosh is cut out of the space between the two goloshes in the vamp. This causes the centre line of the vamp to be cut at an angle that raises the toe considerably above the toe of the last, and produces an excess of line length round the bottom edge of the vamp. If an upper of this type is put straight on to the last, in the position it should be when the boot is made, directly the toe is drawn down a great amount of the excess measure is thrown up round the toe, causing a great many pleats. The solution of this difficulty is to raise the upper at the heel until the end of the toe reaches the toe of the last. The vamp is then in a position to be lasted round the front of the boot, the excess measure being focussed at the joint. When the heel is lowered again, this excess measure is worked out ; this is really the origin of the hoisted method of lasting, and is one of the reasons why it is so difficult to last a whole vamp boot without hoisting, when the golosh is cut to lock in.

To face Page 162.

Plate 77.



1.



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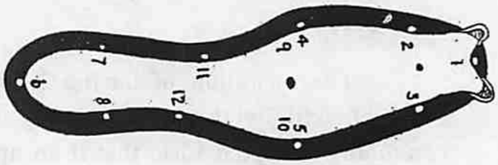

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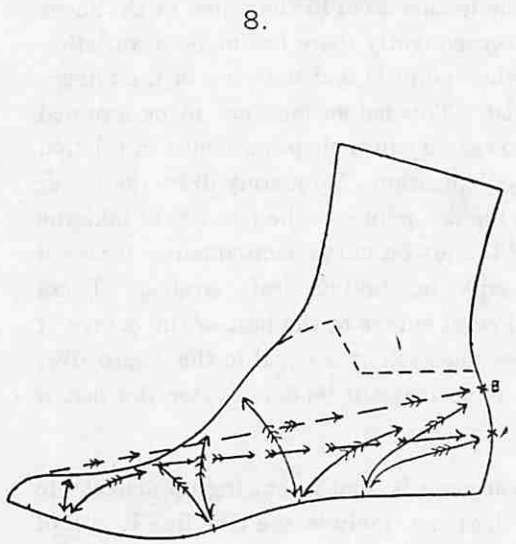

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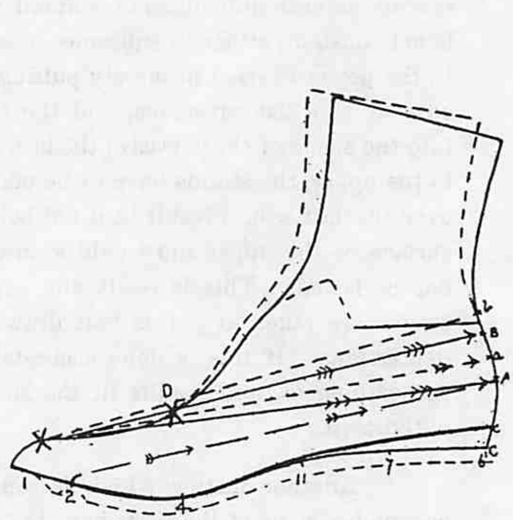

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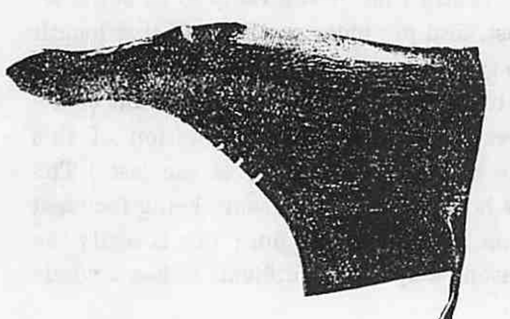

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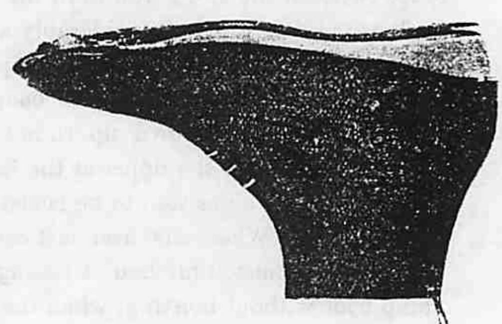
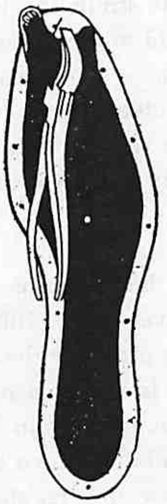


4.

Methods of Lasting.

Plate 78.



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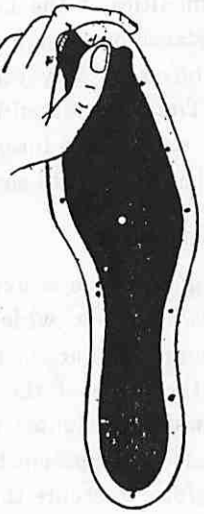

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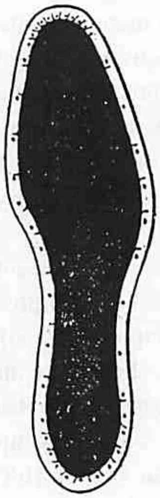
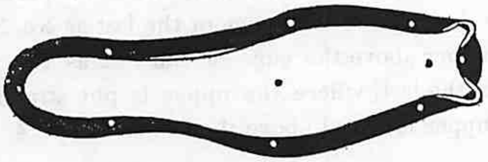
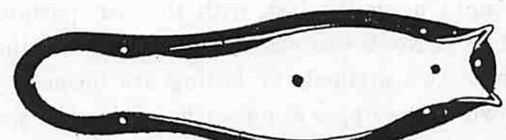


11.

13.

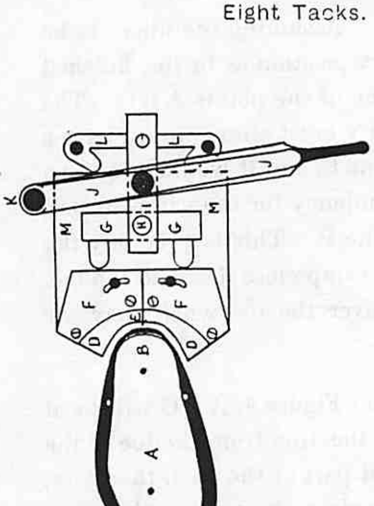


Eight Tacks.

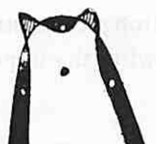


12.

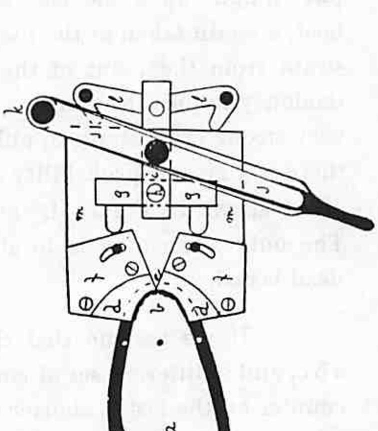
Six Tacks.



14.—Bed Machine—open.



Hoisted.



15.—Bed Machine--closed.

These are only some of the difficulties of the laster, his business being to strain the upper. Any materials put in to make up the substance or to give stiffness to the upper, add to the difficulties of lasting; badly fitting counters or toe boxes, or any other unlevel material, make it exceedingly difficult to produce a well-setting top. The work should reach the laster absolutely ready for its process. He may under some systems be expected to insert the counters and toe boxes, and to tack on the insoles to the last, but he should not be expected to shape anything, or to rectify any error in substance or fit in any way.

The essential principles of lasting will be best explained by reference to the diagrams upon Plate 77. Figures 1 and 2 represent two uppers, which have been strained over upon different principles. It will be observed that although both are tacked down, and both were precisely the same tops, there is considerable difference in the shape of the curve of the back and in the line of the counter. The back curve in No. 1 is much straighter than in No. 2, and the counter line in No. 2 curves slightly upward in the waist. It is also apparent that the vamp of No. 2 is lasted down closer to the top of the last than No. 1; therefore, to secure the same result in both these uppers, starting from the present condition. No. 1 would have to be lasted very much tighter across the joint than No. 2, to draw the vamp down to the last; and No. 2 would have to be drawn tightly in at the waist to secure a straight counter. The cause of this difference is owing to the fact that No. 1 was placed straight upon the last, with the seat portion required for lasting over the edge of the last as No. 3; whereas No. 2 was placed on the last with the edge of the upper above the edge of the last as No. 4. These two methods of lasting are termed: lasting dead to the last, where the upper is put straight down to the upper at once; hoisted at the seat, where the upper is raised above the last as Figure 4.

Figure 5 will help to explain the effect of these different methods. Assuming the upper to be put straight upon the last, so that the points A B C were in their correct position as in the finished boot, a strain taken at the toe as 1, would be equally distributed at each one of the points A B C. The strain from the point of the toe to each one of these parts being equal, any great strain would have a tendency to pull the vamp in a straight line from the top of the toe to point E, and it would require a very strong cross strain to pull this down again. Seeing that there is a tendency for the vamp to rise, there is a greater probability of the line A being more strained than the line B. This is precisely the effect shewn in Figure 1, and it requires a strong cross strain to pull the vamp close down to the toe. The only alternative is to abstain from drawing the uppers too tightly over the toe when they are dead lasted.

If we assume that the upper is raised at the seat, as shewn upon Figure 4, A B C will be at a b c, and a different set of conditions are set up. It must be evident that the line from the toe to the counter on the last is shorter than the line from the toe round the fullest part of the heel, therefore, when we raise the upper at the back, each of the lines at the sides go towards a shorter length on the last. A goes to 'a,' which is obviously shorter: B goes to 'b,' which is above the edge of the last, and which permits the upper to be drawn forward. When the strain is drawn over the toe through the point 1, the pull is against A B, 'b' being above the edge of the last, produces a certain slackness along its line, and therefore permits the upper to be lasted down rather easily across the joint as at D. If the upper is now lasted at the joint and then pulled down at the back, it naturally causes a very close fit between the upper and the top of the last, and a very tight tension round the counter, which has a tendency to throw up the golosh line as Figure 2; but it produces a very close fit between the upper and the last, along the sides of the counter, across the joint and over the comb of the last.

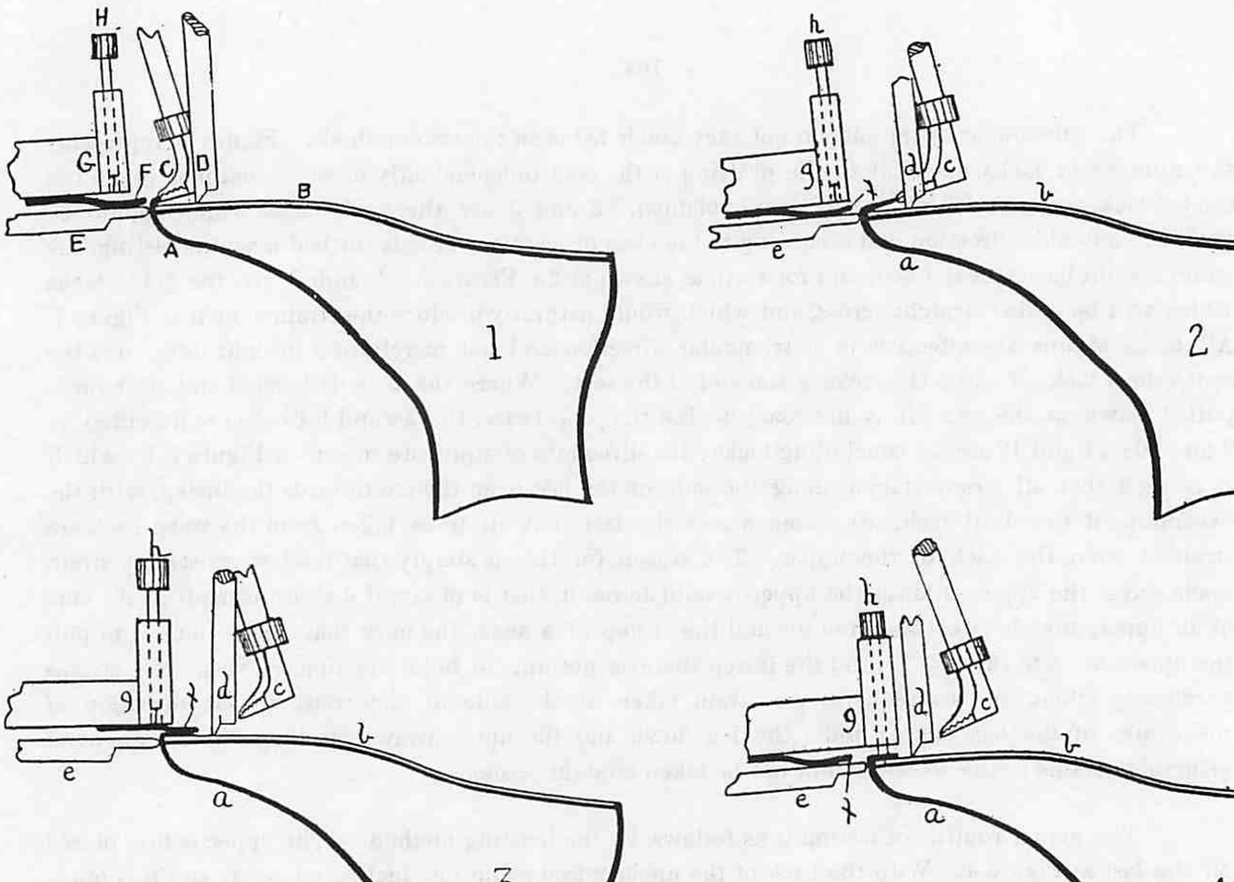
The subsequent operations do not vary much between the two methods. Figure 6 represents the number of tacks essential to the drafting of the boot independently of the actual pleating. 1 is the toe tack, the effect of which has been explained. 2 and 3 are the draft tacks which should be pulled in a double direction and according to the class of lasting. If it is for bed machine lasting, the strain should be across the boot and forward, as shewn at 2a, Figure 5. 4 and 5 are the joint tacks which will be pulled straight across, and which would naturally produce the strain shewn at Figure 7. All these strains are effective in a triangular direction and not merely in a straight line. 6 is the centre heel tack ; 7 and 8 the tacks at the end of the seat. Where the boot is hoisted and afterwards pulled down at the seat, it is necessary to last the joint twice, this second lasting is represented by 9 and 10 ; 11 and 12 are the concluding tacks ; the directions of strain are shewn on Figure 7, by which it is seen that all strains taken along the side of the last from the toe towards the instep, with the exception of the draft tack, are taken across the last, but all those taken from the waist back are strained from the back of the upper. The reason for this is simply that the last resists any strain made across the upper so far as the upper is solid across it, that is to say, if a strain is made at the side of an upper, anywhere between the toe and the instep of a shoe, the most that can be done is to pull the upper down to the last, behind the instep there is nothing to hold the upper except the strains previously taken, and consequently, a strain taken at the side of the waist in the direction of the centre of the leg, simply pulls the leg down and the upper away from the last. As a general principle, strains in the waists should not be taken straight across.

The actual routine of lasting is as follows, by the hoisting method :—The upper is first placed on the last as Figure 4. With the back of the upper raised about one inch, a moderate strain is taken in the centre and the first tack put in. The greatest care should be taken that the seam in the back is precisely in the centre of the last, and that when this strain is taken the lining is first cleared ; this would be done by first taking a pull at the lining, then taking the lining, the outside and the toe-making materials and drawing them all over together and tacking them down. The draft tack is taken next, and a double strain taken as Figure 7 ; this can be done by placing the pincers across the boot, putting the thumb behind the pincers and pushing them forward while the upper is being drawn across. When the tops are cut straights, it is usually best to draw the inside draft points first and then the outside draft points. The next tacks are the tacks 4 and 5 at the joints. A fairly strong pull should be taken at these, although the upper need not be drawn quite down to the last. The boot is now pulled down at the seat and the tacks 6, 7 and 8 put in. Care should be taken here to clear the lining. The lining should be drawn down first, the whole top drawn down a little way, and then drawn up again from the top of the leg ; this will clear the lining. The waist tacks are next put in, pulling round as shewn in Figure 7. This drawing down of the seat will throw up the waist very full ; part of this fullness should now be lasted out at the joint, by knocking out the tacks 4 and 5, and re-lasting the joints strongly with the tacks 9 and 10. It will be found that the boot is now quite close to the last, and that the waist will naturally fall into its place. The strain that is put upon it should be in the direction shewn on Figure 7 ; these last two tacks 11 and 12 complete the lasting of the boot so far as the essential kit is concerned. The following operations consist in pleating the different parts neatly in.

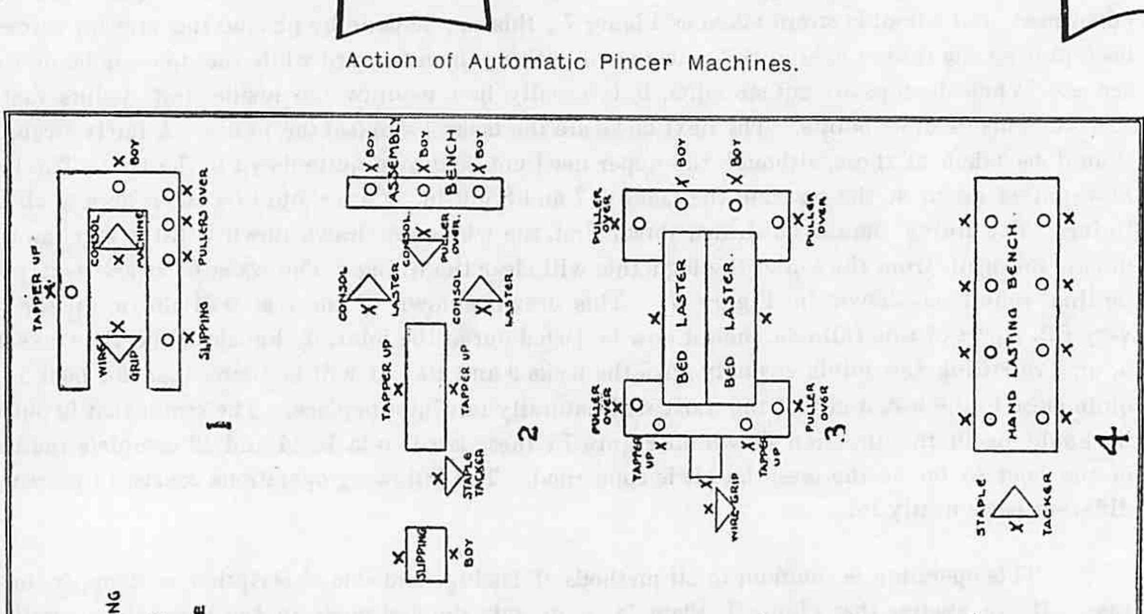
This operation is common to all methods of lasting, and one description will apply in each case. If we assume that Figure 9, Plate 78, represents the first tacks in the shoe, the operation in pleating the toe would be as follows :—The loose stuff between the centre of the toe and the draft tacks should first be cleared with the handle of the pincers, making quite sure that there is no

To face Page 164.

Plate 79.



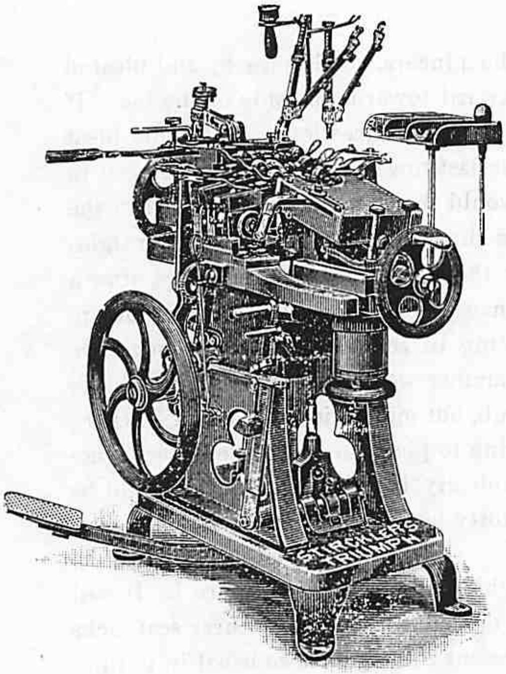
Action of Automatic Pincer Machines.



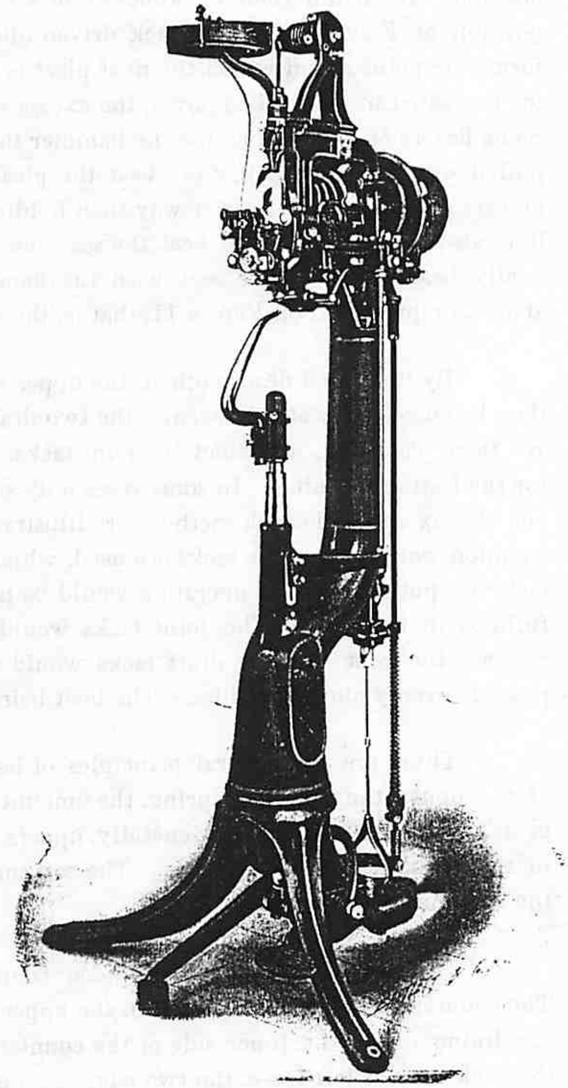
Lasting Teams.

To face Page 165.

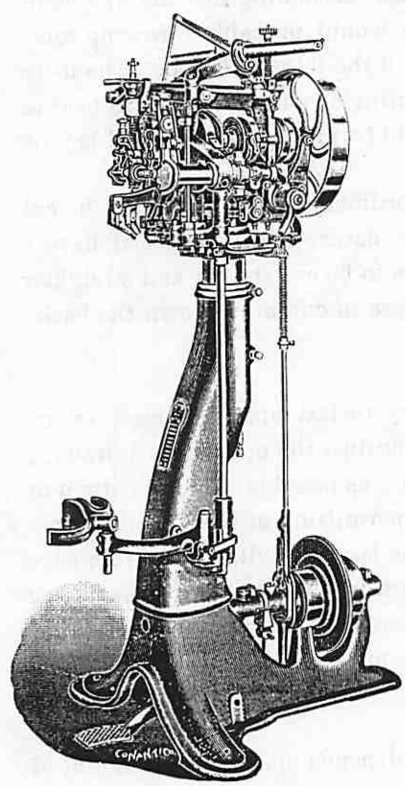
Plate 80.



"Triumph" Laster.



Staple Fastener.



Consolidated Welted Laster.

Lasting and Attaching Machines by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

(See Plate 81).

excess of lining under the toe, a piece should then be taken by the pincers, as Figure 9, and pleated over the centre tack. It will be noticed that the pleat points outward towards the side of the toe. If a cut is made to assist in the pleating, the cut should be made in the same direction. After this pleat is made, the thumb should be pushed from the outer edge of the last towards the pleat, holding it in position. It should then be knocked down flat, the thumb would then be drawn over until in the position of Figure 10, and a tack driven into the pleat made as shewn. This being driven in tight, forms the point round which the next pleat is made, in precisely the same manner ; generally, after a toe is pleated in and tacked down, the excess of leather is trimmed off, made level and beaten down. Some lasters of heavy work use the hammer to assist them in lasting in the pleats. When they have pulled over, as Figure 9, they beat the pleat down with the hammer while still holding it with the pincers ; this is a rather easier way than holding it with the thumb, but only suitable for stiff leather ; it is also quite common to beat the seat down before commencing to pleat, in fact some lasters practically beat in the whole seat with the hammer. When completely lasted, the tacking would be about as represented on Figure 11, that is, there would be about forty tacks in the complete lasting.

By the lasted-dead method, the upper would be put straight on the last as in Figure 1. It will then be tacked over at the toe, and the two draft tacks put in as described before, the three seat tacks are then placed in, and then the joint tacks. This would represent the eight tacks usual in pulling for the lasting machine. In some cases only six tacks are used, in which case the joint tacks are left out, the six and eight tack methods are illustrated on Figures 12 and 13. In very rare cases and very common work, only three tacks are used, which are the three toe tacks. Assuming that the first eight tacks are put in, the next operation would be lasting the waist. This would probably throw up some fullness in the joint. The joint tacks would then be taken out and the joint re-lasted. The tacks between the joint and the draft tacks would now be put in, distributing any foul material as near as possible evenly along the sides. The boot being now tacked up, would be pleated as described before.

These are the general principles of lasting and apply to all ordinary cases ; naturally the cut of the upper, the degree of spring, the amount of foul stuff, and the nature of the material have a great effect upon the detail. Generally, uppers of soft material require to be cut shorter and straighter in the back than hard materials. The soft materials appear to increase in curvature down the back ; the hard materials certainly do not.

The use of completely moulded counters make it necessary to last upon the dead system. The counter should first be placed in the upper, pulling it carefully against the outside, and drawing the lining on to the inner side of the counter and making it as secure as possible. If the bottom of the back seam is left loose, the two edges should be folded over, that permitting of them being drawn clear when the boot is lasted. The upper should now be put over the last, but with the bottom edge about two inches below the edge of the last, it should be drawn forward by the hand and then the leg drawn up until there is the correct amount for lasting over at the seat, this will produce a perfectly clear lining. Some lasters prefer to tack the seat first, or at any rate to put one or two tacks in to hold it. The remainder of the lasting is precisely as described before.

The degree of success attending the use of moulded counters depends upon the accurate fit of the counter and the last. If they fit perfectly, they naturally bed down to the seat of the last and give very little trouble. If they do not, it is scarcely possible to make a satisfactory job without knocking out the moulding round the bottom edge. If the counter touches at the top edge and sticks

out at the bottom, that is, if it is not round enough for the last, it is almost impossible to make a good job of the seat. If the heels are heeled on the last, it is nearly sure to result in unsolid heels, the sides cannot possibly be lasted in a proper manner if they are loose at the bottom edge. If they are lasted by machine, the edge of the counter gives way before the wiper, and one tack is pushed out as the next one is driven. If the counter fits well on the lower edge, but stands away from the last at the top, directly the upper is pulled at the draft points, the lower corners of the counter come over the bottom of the last in the waist. This throws all the blocking out of its correct position, and a fresh line of blocking has to be put in, or the stiffening knocked back at the corners. To sum this matter up, the counters must either accurately fit the last or be simply moulded along the sides, but not turned at the bottom edge.

It would appear that where boots are lasted by the hoisted method, some advantage would be gained by the use of moulded counters, although the moulding would have to be taken out before the boot could be lasted; this is sometimes done. The counter is moulded and then run through a roller sufficiently hard to take out the lower blocking; the laster then has the advantage of pleating in a counter that has already been pleated.

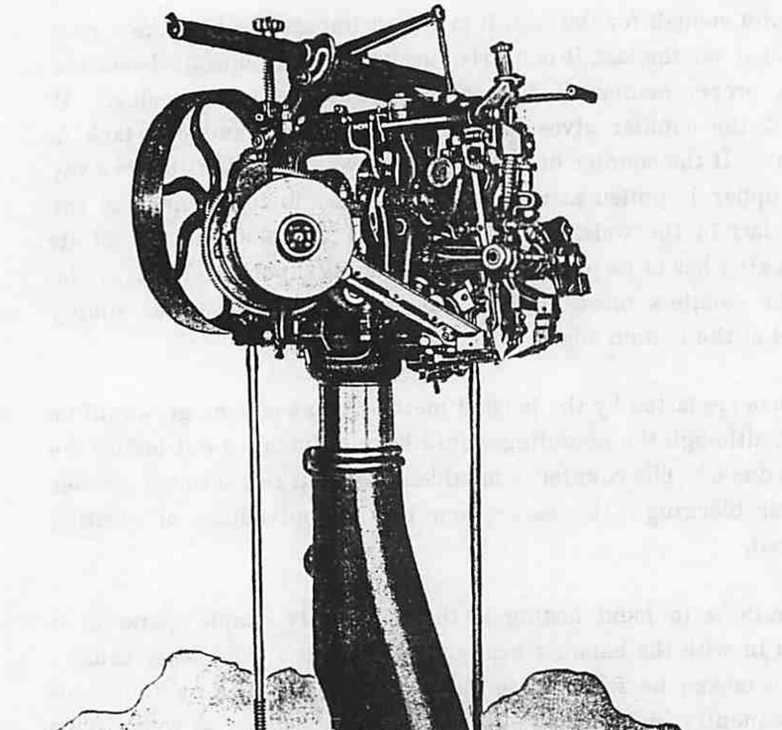
One of the most difficult operations in hand lasting is the apparently simple operation of feeding the tacks before knocking them in with the hammer head of the pincers. The laster usually uses his mouth as a kind of reservoir for tacks; he feeds these through his lips, picking them out with the jaws of the pincers, and frequently incidentally pulling out his moustache as well. This crude method of tacking causes the mere tacking operation to consist of three movements: taking the tack from the mouth with the pincers, sticking it into the leather, and then driving it with the pincer head. The "Standard Rotary New Pincer" simplifies this operation. These pincers illustrated on Plate 96, have a tack reservoir and a tack feeding arrangement under the control of the operator. The jaw of the pincer and the hammer head are very similar to the ordinary pincers, except that the lower jaw is solid and the upper jaw is actuated by a lever connected with the lower pincer handle. The operator having seized the upper and pulled it over by a movement of the handle, feeds the tack, which is planted in the upper, he then simply drives the tack with the pincer head; this is an enormous saving of time, and it is unquestionably a great advantage. These pincers are frequently used to last in the sides of shoes which have had the other parts, toe and seat, lasted in on the wiper machine.

The different classes of work require some modification in the tacking. Blake-sewn work should be tacked over about 3/8ths-of-an-inch from the edge; this will clear the seam well. Machine-welted work should be tacked into the shoulder of the insole. There is also some difference in the number of tacks required. About 40 or 50 tacks are generally used for machine-sewn, but for welted work a much less number are sufficient. It is not necessary to last the waist of the boot that is to be sewn on the welting machine. The machine will pull the waist sufficiently if the upper has been cut in the proper manner. Therefore it is usual to bed the waists of welted work down so that they fit accurately, but not to actually tack them.

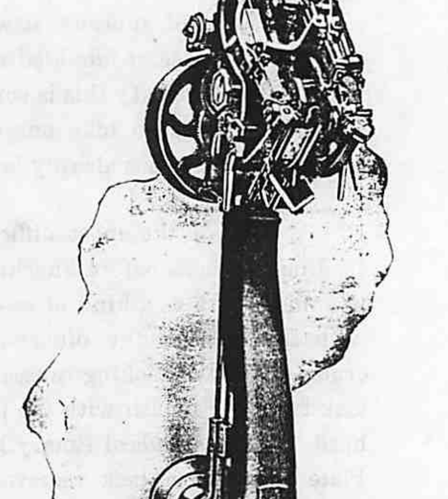
Machine lasting may be practically divided into two methods—the wiper method and the automatic pincer method, although most systems contain some element of both these principles. The wiper method consists of pushing the upper of the boot over the edge of the last by means of metal plates, which are shaped to coincide with the curvature of the last; these are usually confined

To face Page 166.

Plate 81.



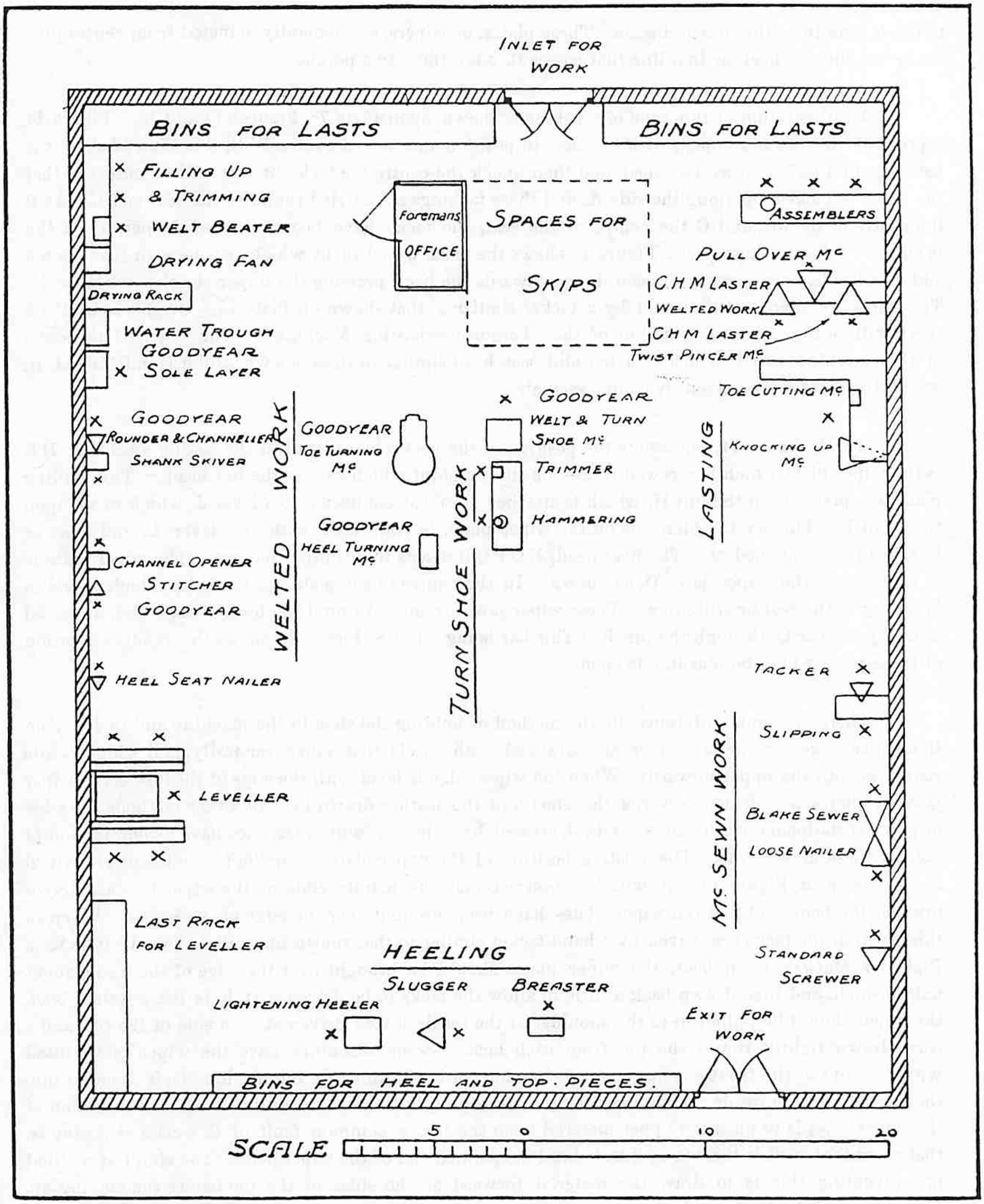
Consolidated McKay Laster.



Consolidated Pulling-over Machine.

Pulling-over and Lasting Machines by
THE BRITISH UNITED MACHINERY CO.,
Union Works, LEICESTER.

(See Plate 82).



Plan of Lasting and Attaching Department, by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

to the lasting in of the toes and seats. These plates, or wipers, are generally actuated from centre pins at the toe and the heel, or in a line that passes through these two points.

An illustration of this type of machine is shewn upon Plate 78, Figures 14 and 15. Figure 14 represents the machine open, with the shoe in position and tacked over. With this kind of shoe it is usual to first tack over as described, and then knock the centre toe tack out. It will be observed that the shoe is tacked up along the side A, and these tackings are carried round to the seat tacks. At B the centre of the toe, and C the centre of the seat, the tacks have been removed to permit of the machine wiping in those parts. Figure 15 shews the parts wiped in, by which will be seen that the toe and seat heads, or wipers, have been drawn towards the boot, pressing the upper closely over the sole. The parts are then tacked round by a tacker similar to that shewn on Plate 75. On this same Plate there will be found a representation of the "Ferguson's Lasting Machine." The essential principle of this machine was two heads, a toe and seat head similar to those shewn, and a Hand Tacker, in which the tacks were driven by compressed air.

A B C, Figure 14, represents the position of the boot when placed in the lasting machine; D E is the wiper plate which is screwed to F—the sliding point which carries the toe head. This sliding plate G is pivotted on the pin H, which is attached to a bar connected to a lever J, which turns upon the point K. The bar I, which acts on the wiper plate, is connected with the lever L, and more or less, to the sliding bed M. The heel head, N O P Q R S, acts in a similar manner. The wiper plate N is screwed to the wiper jaws O, as shewn. In the centre of the plate is a small lip which assists in breaking in the seat or stiffening. These wiper jaws are moved round the lever pins, which are acted upon by the bar Q, through the pin R. This bar being set at S, Figure 14 shews the relative position of these parts when the machine is open.

There is some difference in the method of holding the shoe in the machine and in applying the wiper edge. Some machines are arranged with heads that move vertically, and which, while rising, smooth the upper upwards. When the wiper edge is level with the edge of the insole, the wiper jaws or plates are drawn towards the shoe and the leather drawn in. By other methods the edge of plate is stationary while the shoe is depressed by a lever; some machines have a combination of each of these movements. The relative position of the wiper plates after the toe and seats are wiped in, is shewn at Figure 15. It will be observed that the handle ends of the wiper bars are drawn towards the boot, and that the wiper plates have been brought over the edge of the insole. When in this position the tacks are driven by a hand-tacker similar to that shewn upon Plate 75. If it is for a Blake or Mackay sewn boot, the wiper plates should be brought over the edge of the insole about half-an-inch, and then drawn back a little to allow the tacks to be driven. If it is for a welted boot, the upper should be pulled in to the shoulder of the insole, a tack driven at each side of the toe, and a cord drawn tightly round the toe from each tack. Some machines have the wiper plates fitted with a groove at the front edge to take this bracing cord. In this case the machine beds the cord into the shoulder of the insole during the operation of wiping in the toe. Seeing that the natural action of the wiper head is to push the upper material from the toe, a common fault of this class of lasting is, that some foul stuff is thrown up just behind the pointed end of the wiper plate. The simplest method of preventing this is to draw the material forward at the sides of the toe before the tacking up. If the sides of the toes are drawn strongly forward, it will counteract the tendency of the wipers to push back, and produce a perfectly clear toe with the wiper head. The same remarks apply to the

seat. The two tacks next to the wiper end should be drawn strongly towards the seat, clear in the waist. As the wiper head comes round, it will carry the stuff back again, still keeping a clear waist and producing a seat which is also clear to the corners.

The "Triumph Lasting Machine"—Plate 80—has a special metal plate which seizes the whole of the toe as in a metal jaw, shaped the same as the toe of the last. This holds the whole of the front part of the toe, strains the boot from it, and holds it until it is operated upon by the toe wiper. This really represents the same effect as the pull of a pair of pincers which grip the whole of the toe from side to side in one specially-shaped jaw, and so put a strain upon the whole surface of the toe which could not be applied to a small portion. The effect is, that a draught along the side of the boot from the toe to the counter is secured which could scarcely be equal by any other method.

There are several different kinds of Hand Tackers which, although similar in some respects, differ in the details of working. They all have a tack raceway which is fed from a box; these tacks are divided by a mechanical divider at the bottom of the raceway and near the point of the plunger. The action of the plunger operates the separator, which feeds the tacks into the nozzle of the tacker. Upon the plunger descending the tack is driven. In some cases the downward movement of the plunger feeds the tack and drives it; in other cases the tack is fed and driven afterwards. The "Triumph Tacking Apparatus" has a split nozzle which holds the tack, keeps it vertical, and prevents it turning on one side during the driving of the plunger. Some of these machines are held in one hand and the plunger driven by a blow with the hammer held in the other hand. As mentioned before, the "Ferguson Tacker" is operated by compressed air. The first movement of the plunger or nozzle opens a valve and admits the air from a pump, which drives the plunger and the tack. Other machines depend upon the weight of the plunger and a downward thrust of the operator's hand to drive the tack. There is very much to be said for and against each of these methods. The average operator becomes used to some one tool and generally prefers that to any other.

The pulling over of the upper preparatory to it being operated upon by the lasting machine, should be done with some reference to the action of the machine being worked to. Each machine has some peculiarity, but as a rule, only in minor points. These can generally be remedied by some intelligent modification of the preliminary operation. All wiper actions have a tendency to press back from the centre of the movement, and therefore the upper should be pulled forward in the opposite direction by the tacker over for this type of machine. If care is taken in this matter, and the sides are lasted in in a practical manner, the boot lasted by wiper machine should be quite equal to a completely hand-lasted boot. In fact, in the case of some of these machines a better result than is generally possible in hand-work can commonly be attained.

The four illustrations upon Plate 79 will assist in the understanding of the mechanical principle of the Automatic Pincer Machines. The essential mechanical parts are really the six shewn. In Figure 1, the boot is shewn pressed up to the machine. A represents the top; B the insole; C is the pincer of the machine, it is shewn in the position where it has just grasped the top; D is a fulcrum with a sharp end that holds in the inner sole and keeps the boot from being drawn back when the pincers pull against the toe; E is a stop against which the toe of the boot is pressed; and F is a wiper that wipes in the toe behind the pincers, and holds it while it is being tacked by the tacker rod in the plunger race H, the race being carried by the tack race carrier K. Figure 2 represents the pincers having drawn the upper over the toe; Figure 3, where the wiper is holding the upper down

until the tack is driven which attaches it to the insole, the tack race being brought forward for that purpose. Figure 4 shews the tack race in the forward position, having just driven the tack: the wiper is returned to its original position, and the next movement carries the tack race back and leaves the machine ready for the next operation, which is simply a repetition of that previously described. This description for the sake of clearness has described the action of a straight-pulled pincer.

The machines—See Plates 80-81—are now fitted with a twist pincer that turns the pleat sideways in precisely the same manner as that adopted by the hand-laster when pleating round the toe: this is a very great advantage to the simplest form of machines. The practical operation of this machine has a great effect on the results obtained. Seeing that we have the twist pincer, and that it can be set any angle in relation to the side of the boot, there is no practical obstacle to a close imitation of the best methods of hand-lasting. In fact it will be observed that the machine repeats the hand operation, the pincers act much the same as the hand pincers; after the material is pulled over and the twist pincer has formed the pleat, precisely the same as the hand-lasting, the wiper holds the pleat down exactly as it is held down by the thumb of the hand-worker. A tack is then driven behind the pleat precisely the same as in hand-lasting, and seeing that each one of these operations has been designed to obtain the best result, the total result round the boot should be of the highest order.

The competition between producers of modern boot and shoe machinery has had a most beneficial influence upon the manufacture of shoes: it has resulted in the invention of apparatus of a perfection that shoe workers had previously declared was impossible to produce. Most of these machines are really labour-saving machines in addition to being much faster in the execution of the processes. The competition has also evolved systems of manufacture based upon the production of the machines of different machinery manufacturers who, at enormous cost, have produced complete sets of machines. These sets include, from the machines in one department, to the equipment of a whole factory. No excuse is offered for special reference to the particular machinery producers illustrated in this work: the complete representation of machinery could not have been secured without their support, and while declining to entertain any of the differences of opinion inseparable from competition, it is believed that the machines described here are the best of their kind. The magnitude of the business is represented by the 98 illustrations in this book of the machines produced by the British United Machinery Company, who supply every machine required in a modern factory. The Standard Rotary Machine Company, who have grouped complete sets round their welting and attaching systems; Messrs. Singer, in light upper stitching machines; The Northampton Machinery Company, in heeling plant; Messrs. Gimson, in heeling and finishing machines, and Messrs. Jackson and Poachin, in every class of apparatus for the finishing of the bottoms. The British United Machinery lasting machines illustrated in this Chapter are, the "Consolidated Hand Method Puller-over:" "Triumph Lasting Machine;" "Consolidated Hand Method Laster—McKay Work; "Consolidated Hand Method Welt Laster:" "Carter Pinking Tool," beside the auxiliary tools.

The "Consolidated Pulling-over Machine" is a natural development from the lasting machines, although the process is preliminary to lasting. There is a great similarity in the method of feeding tacks, the pincers, and the wiper between this machine and the ordinary laster. The head is provided with three independent pincers suspended from rocking levers, each under control of a spring, adjustable to the strength and strain to be applied to the material. Between the extended jaws of the pincers is placed the edge of the assembled upper, the insole and last resting against a presser. The jaws close automatically, followed by a lifting of the pincers and descent of the pressure, stretching

the upper at the toe to the last. The machine stops, the operator examines the top and, if necessary, squares it by swinging a lever located to one side of the machine. The upper may also be shifted across the body of the last, by moving one of the side levers downwards, thereby relieving the tension upon the compressed spring of the opposite lever, causing the latter and its pincers to rise automatically, and with it one side of the upper, without releasing the strain upon the leather. The sole presser, as it swings upon its pivot, forces the last and sole downward and backward into the suspended upper. By adjusting a stop block, the presser is given a double movement whereby the last and sole are pressed downward and forward into the upper, effecting what is known as back-lasting.

The operator again starts the machine. The tack-driving arm and pincers are carried inwardly, and the upper is released from the grip between the supporting arms.

The tacks are assembled from a hopper into a number of races, from which they are separated and dropped into pockets from which they are driven. There is a brass tack race which carries two tacks and a wiper to each pair of pincers. Therefore, two tacks are driven behind each pair of pincers.

This machine is a thorough efficient machine, imitating precisely as the companion machine—"The Consolidating Laster"—the action of the hand craftsman.

The machine is driven by a belt and constructed to take all sizes of lasts, from a man's 11's to a child's 10's. It will pull all kinds of leather and canvas, or any other material without injury. The capacity of the machine averages from 720 to 1500 pairs per day of nine hours, according to kind and quality.

The Automatic Pincer Machines of the Consolidated type practically repeat the hand method of pincering in the upper over the last. There cannot be much doubt but that a greater amount of strain is effected on the upper in proportion to the strength of the pull, when that strain is applied to separate portions at distinct periods: that is to say, when the upper is pulled over piece by piece, and naturally strained at each pulling, the total effect is that it is pulled closer down the last than when it is pulled over by a less number of operations. This is the essential difference between hand-lasting and bed machine lasting, and this principle is mechanically applied by the method illustrated in the "Consolidated Lasting Machine."

The minor differences in the processes of pulling over have precisely the same effect by this method as by the hand method, and if it was practically any great advantage, the uppers could be hoisted as a preliminary operation to the lasting by this method as by the hand method.

Tribute to the pioneer mind of the original inventor, J. E. Martzeliger, who conceived this hand-method laster, cannot be paid any better than to call attention to the fact that the principle of the machine has remained unaltered during all its development.

The pincers are positively closed by a cam, and do not tear out even the most delicate upper leather.

The edge gauge has a very necessary adjustment which enables all classes of work to be done without changing parts.

No better method of handling loose tacks for fastening the upper to the sole has ever been invented than the one used on this lasting machine. A double raceway enables two sizes of tacks to be conveniently driven, and the change can be made of the movement of a lever.

This machine has been adapted to last in work for welted work, and a special movement has been added to it by which the tacking arrangement is disconnected and a wire-feeding arrangement brought into action. The boot having been tacked over and a steel wire inserted in the machine, the end of the wire is twisted round the tack at the side of the joint about 4 inches from the toe, a little more on the outer side, a little less on the inner side. The wire from the side tack to the machine is made taut, and outside the amount of upper allowed for lasting over. The upper is now seized by the pincers, pulled up, twisted round, and held while the wire beds the upper into the shoulder of the insole.

A sectional wiper acting in conjunction with the pincers, beds the wire into the split channel and wipes the material at the same time. By this means the work of the pincer is bedded into and retained along the edge of the upper until it reaches the opposite tack, and the wire is laced round the tack and the toe is lasted. The pincers used are the latest improved devices, with a twisting pull and a straight pull, both under the operator's control, which enable all the different parts of the shoe to be lasted with the same judgment and skill as in hand-lasting. These pincers manipulate the upper leather the same as a hand-laster twists and pulls to remove the wrinkles and take out the stretch of the stock. After having been developed in this welt-laster, the same features were added to the lasting machine for McKay sewn shoes, both machines being therefore perfect in this respect.

A new automatic wiring device has been applied to this machine, the importance of which will be readily understood by all manufacturers of Goodyear welt or turned shoes. By its use the toe is wired simultaneously with the operation of lasting, entirely obviating the use of tacks in lasting the toe. The upper in this way is drawn more tightly and smoothly to the shoulder in the channel, and held in a much firmer manner than it is possible to secure by use of tacks, leaving the shoe all strung or braced ready for the sewing machine. It not only produces much better work, but saves the cost of tacks, pulling the same, and the expense of stringing the toes after lasting.

Special devices have been designed to meet the requirements of peculiar work, and include the "Carter Pinking Tool—Plate 81, and the Cutter, which is part of the apparatus of the "Consolidated Laster" as sent out for very heavy work. The "Carter Pinking Tool" takes a V shaped piece out of the edge of the upper at any point the operator thinks it would be an advantage; this simply imitates the trick of the old-time laster. The "Cutter" for heavy work is another device that is a repetition of old-crafts' methods, it makes a cut in the manner described on Page 165; the direction of the cut being the same as the direction of the pleats.

The systematic arrangement of a team of operatives executing the different processes that constitute the entire process of lasting, is due to the invention of the American manufacturer. It is a peculiar fact that the English operative or his representative, has generally shewn some opposition to the execution of a portion of a process by the hand-worker, unless in conjunction with machines. This has made hand teams practically prohibited in England, although common in America, but has probably contributed towards the perfection of machine methods as much as any other factor.

The usual arrangement of a team working to the "Consolidating Lasting Machine" is shewn on Plate 79. For ordinary men's work, this usually consists of three men and a boy working at a team—the boy puts in the stiffenings and passes the work to the men. These pullers-over should be arranged round the machine, so that the operator can receive the boots without any great labour. The bench in front of the pullers-over should be about the height of the pincers or a little lower. He will then be able to take the boot straight from the bench to the machine, without much alteration in the height at which he carries it. It is an advantage to have the pullers-over arranged upon the right hand side of the operator, and to be so close that he can reach the boot from either man quite easily. The tapper up, who taps the upper level after the machine, may be on the left-hand side, so that in taking from right to left, it is passed quite out of the way of the pullers-over. It would be passed from the tapper up to the staple tacker, who would tack on the sole ready for slipping the boot. If the operator of the staple tacker picks up his boot with the left-hand, he could carry it across to the right side to the puller-off. The front of the pulling-off bench should have a slide into which the lasts can be put. These lasts should slide down to a boy who would collect them, put them into pairs, and supply the tackers on with them. It is generally necessary to have three pullers over, one tapper up, and two pullers off, a boy for putting in stiffenings, and a boy for odd jobs.

Team 1 is the usual consolidated team as arranged in England. This consists of five men and a boy, but may be arranged in different proportions. The boy is expected to put in stiffenings and pass the work to the pullers-over. For good work, pulling over at eight points, three men would do about 180 pairs per day; if the work was of a lower quality and only six tacks were wanted, or six points, each laster would be expected to pull over about eighty pairs. This may be increased to ninety if only three tacks were expected. The operator on the machine is expected to go the same pace as the pullers-over, and to represent the quality of the pulling-over in the actual tacking on the machine, In all these matters much depends upon the nature of the material and the manner in which the preparation of the upper and the fit of the stock has been systemised. This would also effect the tapping up; one man would be sufficient for the team as arranged, but if there was an increase of the output, there would also be probably an increase in the need for tapping up; this makes an increase in the output not always so profitable as it may appear by mere numbers. From the tapper the work goes to the wire grip operator, this man or lad is often expected to do too much in the way of making stuff fit. The sole should reach him correctly fitted, that is, the outer sole should be attached to the parts that go next it in the attachment of the bottom; they may be attached by tacking or by cement, but in any case they should be attached correctly. The operator takes the sole in his hand between the outstretched fingers and the thumb, with the boot turned towards him so that he can see the relation between the width of welt and the edge of the upper; he then drives a tack into the toe end of the channel, placing it so that it misses the stitches. The next tacks are usually placed in the joints and then continued at the seat. Some latitude should be allowed in this matter; some operatives prefer to tack at toe and then at the seat and then at the joint; the order is of less consequence than the exact position of the sole.

Slipping the lasts should be easily managed by one lad, who should be able to give the tapper-up a hand if he was pressed; there should be a race or shoot between the slipper-off and the underneath part of the bench occupied by the counter-fitting boy, so that as the lasts were slipped by simply putting the lasts in the shoot in front of the bench they would be returned to the boy responsible for the first part of the operations; this saves a lot of time commonly lost in carrying the lasts about.

Where the "Consolidated Pulling-over Machine" is in use, a different arrangement is required. The pulling-over machine being equal to about six men. This team requires two boys to put in stiffenings, one man on the "Consolidated Puller-over," one man to clear linings and put everything straight, two "Consolidated Machines" and two tappers up, this should produce something about 2,000 pairs men's work per week.

Team 2 is the complete team of Consolidated Puller-over and Lasters; three lads or men assemble the stuff, fitting in stiffenings and passing the work to the puller-over; the action of this machine is described elsewhere. The puller-over is about equal to six men, and consequently requires two lasting machines to work to it. The work in this case is preferably passed to the operatives upon racks, being wheeled to the various processes. The remarks made respecting the quality of the work in connection with hand pulling-over applies to this team. The laster may put in forty tacks or fifty tacks according to the degree of excellence required of the fit of the stuff, and may last anything from a 1,000 to 1,500 per week per machine.

This team would require two tappers-up, unless the fit of the uppers was exceptionally good or the material of a kind that naturally laid down well. The wire-grip operator would have to be kept busy if he kept up with this team, but it would scarcely require two machines; the better plan would be to have an exceptionally good wire-grip operator. The slipping would or could be done by two lads, who would be held responsible for the lasts being returned to the assembly bench.

The "Bed-lasting Machines" have a capacity about half the "Consolidated Machines." The plan of a double team is shewn on Figure 3. One boy puts in stiffenings, pairs up lasts, and acts generally as an asssistant. Two operators would pull over for this machine about 50 pairs a day each; each team therefore would consist of four persons: a boy, two pullers-over, one operator. The "Wire-grip Machine," to which the boot goes after leaving the "Consolidated," should stand next in relation to the lasting machine. The work should be provided with the different parts attached, seat graft put on, middle soles on, and runners and shanks. The operator should fasten the sole on with about five tacks, but run a fair row of the fastenings down the seat. This portion of the process is very often done badly, and very often put in the hands of an inexperienced operator, although a mistake made at this stage probably spoils the boot. It is certainly a pity that some mechanical means have not been devised for placing the sole in its correct position in relation to the upper; at present it is largely a matter of judgment. From the "Wire-grip" the boot next goes to the "Channel Opener," and then on to the "Blake Machine." From the "Blake Machine" it goes to the "Channel Layer," and then to the "Levelling Machine."

Figure 4 represents a hand team in which each operative is expected to completely last about 24 to 30 pairs of men's work per day—this includes the putting in of stiffenings. Although the writer was associated with a hand team working in England nearly forty years ago, and this team attempted to produce the highest class hand-sewn work, very little progress appears to have been made in this matter. Seeing that the number of skilled men capable of completely lasting a shoe is rapidly decreasing there appears little prospect of making hand teams practically successful in the future. The order shewn is self explanatory, and is probably the simplest arrangement possible.

CHAPTER XI.

Bottom Making, Laying and Attaching.

ASSUMING that the boot has arrived from the lasting room, the next operation would be filling the bottom in such a manner that the sole may be laid upon it, under conditions that a flat bottom would be produced. The surface produced by the lasting-over varies with the substance of the work, and the method of fastening it to the insole. Ordinary Blake-sewn work has a ridge round the edge of the insole produced by the substance of the upper lasted over ; the height of this ridge, and its effect as regards the bottom filling, depends upon the shape of the last. A round bottom last naturally throws up the centre of the insole, and therefore a shoe of this type does not require so much stuff in the bottom to make the centre level with the sides, as if made upon a last with a flat bottom. The amount and shape of the bottom filling consequently depends very much on the curvature of the bottom of the last and the substance of the upper. A flat-bottomed last would require a filling that would fit in the space on the insole not covered by the upper ; a round-bottomed last would not require more than filling in at the sides of the upper.

The materials generally used for the purpose of filling, are leather, felt, dessicated cork and cement, leather skivings, ground leather waste and cement, and incidentally scraps of cardboard.

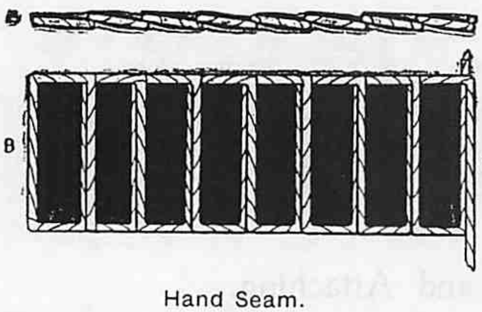
For really solid work, a leather filling is the best. This should be the same shape as the space required to be covered, and should be skived round the edge so that it blocks down to the edge of the upper, or the edge of the seam ; if the last was round at the bottom, the filling should be skived away in the middle. It is an advantage if this filling is cut to go right through to the seat. For water-tight work the filler should be thoroughly cemented in, and for very heavy work a mixture of wax and gutta-percha should be run in the bottom before the filling is put down. This is probably the most solid form of bottom filling used.

Felt is the most commonly used material, and if cemented in, is an excellent substitute for leather. The principal defect of felt fillings is caused through them being put in loose ; this permits them to work up in the wear and to form ridges under the insole. If properly fastened in two or three places, it is one of the best bottom fillings. This material is sometimes put in for the purpose of stopping creaking, but not always with success. The most commonly used materials to prevent creaking is French chalk powdered over the flesh of the insole ; it has also been found that a coating of black lead put upon the flesh of the insole will prevent creaking. A narrow strip of sheet rubber cemented along the flesh of the insole, is a certain preventative.

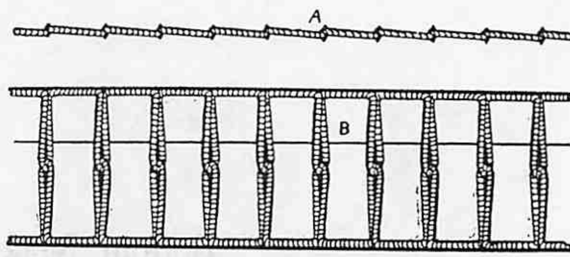
Ground cork and cement have been mentioned as being used for the filling in of heels, it may also be used for the filling in of bottoms, but the proportion of cement should be rather high, the least dryness in the cork causes it to powder and work up into lumps under the insole. Leather skivings should be tacked in, otherwise they are sure to work up during the wear.

To face Page 174.

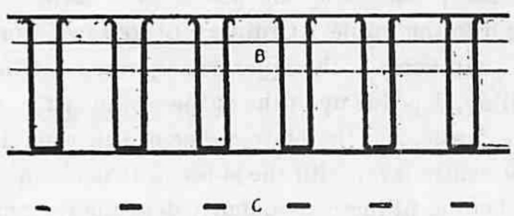
Plate 83.



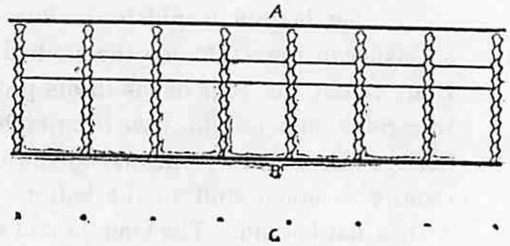
Hand Seam.



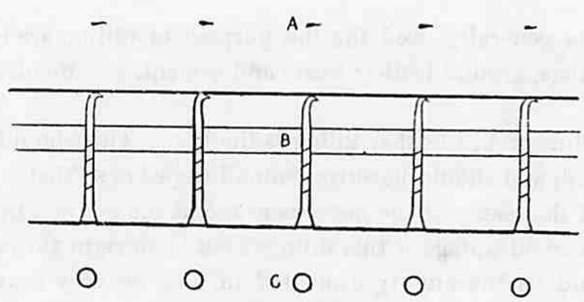
Lock Machine Stitch.



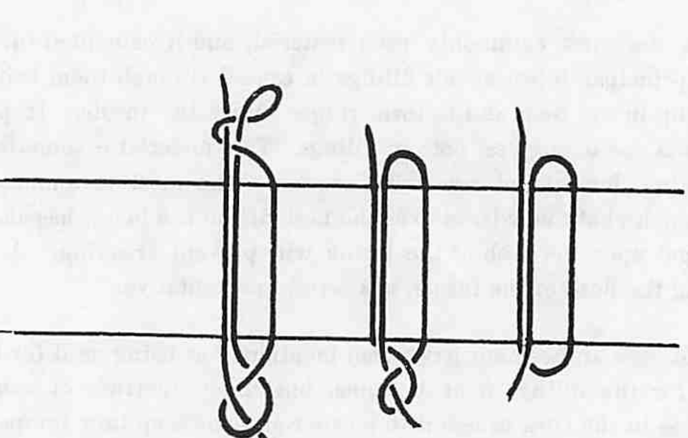
Staple Fastenings.



Screwed Seam.



Rivetted Seam.

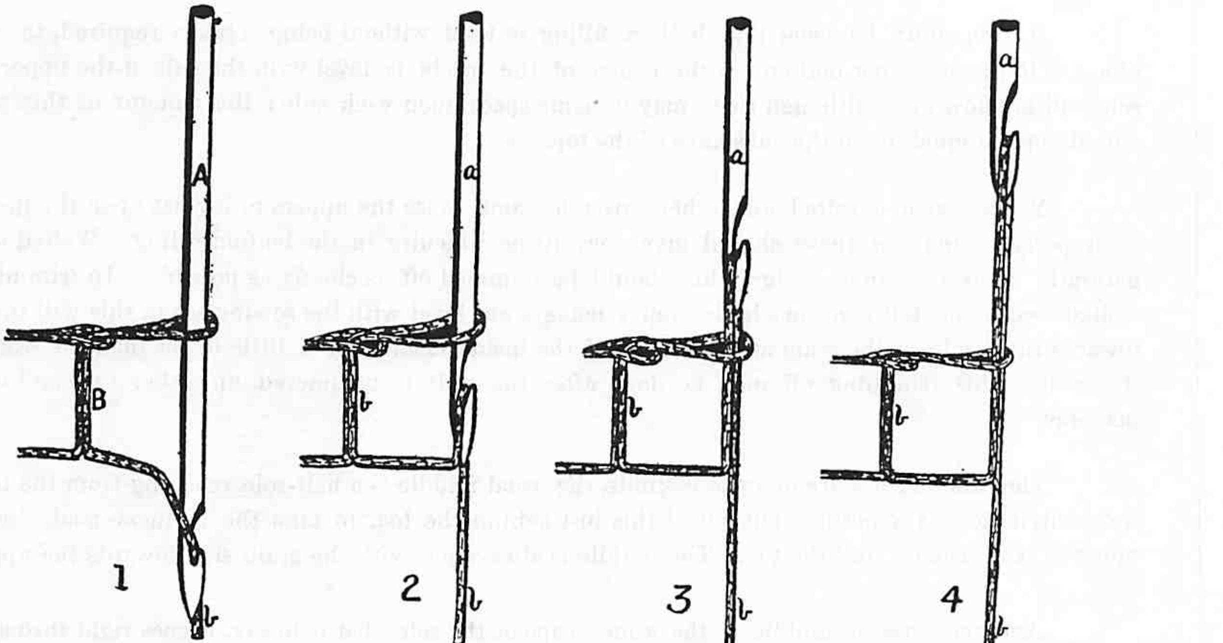


Method of making various Hand Seams.

Seams used in Shoe Manufacture.

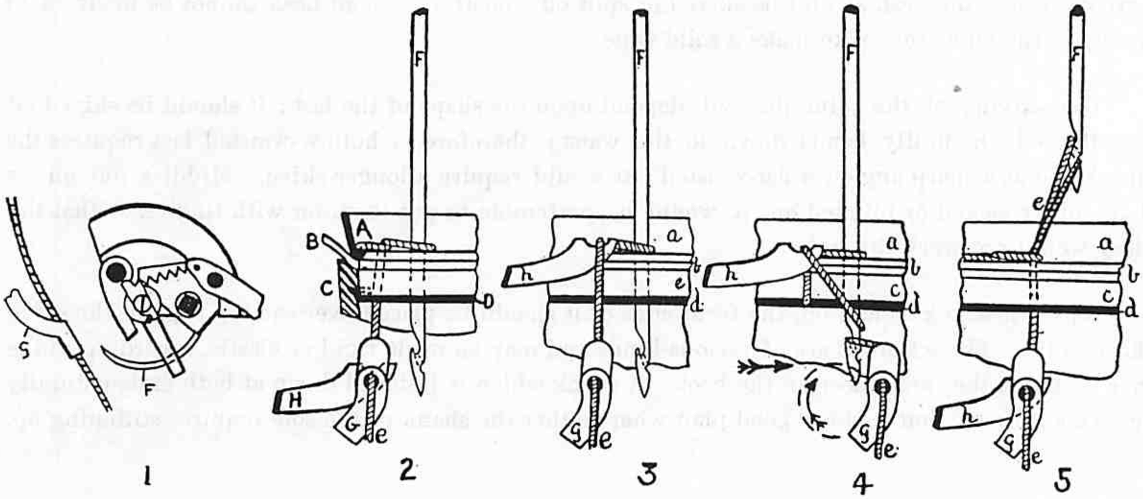
To face Page 175.

Plate 84.



The Action of the "Blake" Needle.

The "Blake" or "McKay" Chain Stitch.



Action of "Goodyear" Inseam Machine.

It frequently happens that bottom filling is used without being actually required, the only object is to procure a flat bottom ; if the centre of the insole is level with the side of the upper, the sole will lay down flat, although there may be some space upon each side ; the amount of this space would depend much upon the substance of the top.

McKay sewn, rivetted, and other through seams, cause the uppers to lay flat upon the insole ; if properly beaten out these should give very little difficulty in the bottom filling. Welted work naturally throws a higher ridge, this should be trimmed off as closely as possible. In trimming a welted seam, the knife of machine should make a cut level with the sewing seam, this will incline towards the insole, as the seam at the bottom of the inside channel is a little lower than the seam on the welt. This trimming off may be done after the welt is hammered up either by hand or by machine.

The middle soles are of various kinds, the usual middle is a half-sole reaching from the toe to the joint, a piece is sometimes cut out of this just behind the toe, to take the fullness made by the upper as it is lasted round the toe. The middle is always put with the grain side towards the upper.

Another class of middle is the same shape as the sole, that is to say, it goes right through to the heel ; this is called a through middle, and is used where it is intended that the bottom should be attached by a double seam. By this method the middle is first sewn to the upper and insole, and then the sole is stitched to the middle. Where the stitching is not required on the inside waist, it is usual to cut away a strip. These are called three-quarter middles, and the stitching is referred to as three-quarter stitching. This method of construction produces a sewn and stitched boot, with a different attachment along the inside waist.

In some cases the half-middle has the centre cut out and filled with cork, this strip is sewn by the " Blake Machine." The correct term for them is hollow middles, but of late years they have been referred to as Blake welts. A rather nice development of this is where the edge of this welt is covered by a strip of glace kid or other material increasing the substance of the boot and forming an embellishment for the edge without adding much to the weight.

In some classes of work a strip is cut similar in shape to a split lift, tacked round the edge to make up the substance, and called a runner. Middles should be skived according to the class of work they are used for ; the flesh should be skived or split off smooth ; a rough flesh cannot be made to fit accurately to the outer sole or to make a solid edge.

The skiving of the joint line will depend upon the shape of the last ; it should be skived off so that the sole naturally bends down to the waist ; therefore, a hollow-waisted last requires the middle skived at a sharp angle ; a flat-waisted last would require a longer skive. Middles put on by hand are either tacked or blinded on, it would be preferable to put them on with tingles, so that the grindery would not work through.

Where a shank is laid on, the front edge of it should be placed over the top edge of the skive on the middle. These shanks are of various kinds and may be made rigid or elastic, according to the manner in which they are placed in the boot. A shank which is fastened down at both ends naturally produces a stiff boot ; but this is a good plan where either the shank or the sole requires stiffening up.

If the waist of the boot is required to be elastic, the shank should be either fastened down one end, and allowed to run loose at the other, or it should be fastened in the centre of the waist by two or three tacks, wide enough apart to prevent the tack turning out of its place.

Shanks made of leather or of wood should be nearly the shape of the waist. For welted work the shanks are usually of leather; for machine-sewn, wood or composition. Where a smart boot is required, it is a good plan to dispense with the shank to skive the sole at the sides of the waist, and to fill up the space at the bottom with felt. This will produce a stiffening of the waist without destroying its elasticity.

Steel springs are sometimes used in high-heel work; they are preferably fastened down at one end and allowed to run free in a narrow slot at the other end. It is preferable that they be fastened down at the joint, and that they run free under the heel.

All these parts may be tacked together with the sole before attaching or laying. They should certainly be blocked true to shape, so that they bend down to the upper and the bottom at once.

The attachment of the middle soles depends upon the class of work being produced. If it is desired to make a light boot with a stitched forepart, it is advisable to have the middles sewn on by the " Blake Machine." This method is adopted for all imitation corks and rands. For a heavier class of work the middles are screwed on, but this produces a very solid class of boot. Middles used for stitching should have a good, hard grain. This style of attachment is commonly used for men's heavy work that is to be stitched through to the corner of the heel.

Soles should be blocked to shape so that when put down on the bottom of the boot they go into their correct position at once. The flesh of the sole should be levelled so that it makes a good seam with the middle or inner sole. Where the seat is grafted, the graft should be skived and placed on top of the sole, so that the sole leather extends as far as possible round the seat.

Ladies' single soles ase commonly skived at the side of the waist so to produce a close waist; they are fastened on either by blinding or tacking. If they are tacked, the tack should be placed through the lip of the channel; if they are blinded, not more than five blinders should be used. The seat is usually sprigged round. Where soles are laid in the rough before being dyed or cut out to shape, the waist may be skived by the " Goodyear Shank Skiver."

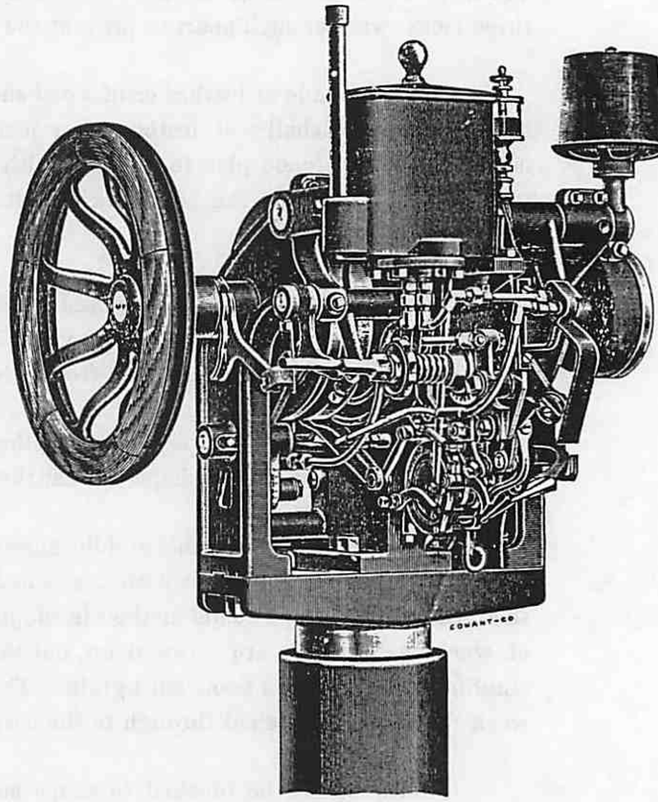
In actually laying the sole or the middle, the greatest care should be taken that the correct width of welt is preserved; this can scarcely be done with the bottom of the boot towards the workman. The sole should be placed grain side down in the palm of the hand, and the boot placed upon it exactly in the position that it is required to be; it should be then turned over, put on to the jack, and the sole attached by driving tacks as previously stated.

When laying soles in a very rapid manner, it is usual to judge by placing the fingers over the edge of the sole and determining the position by the sense of touch.

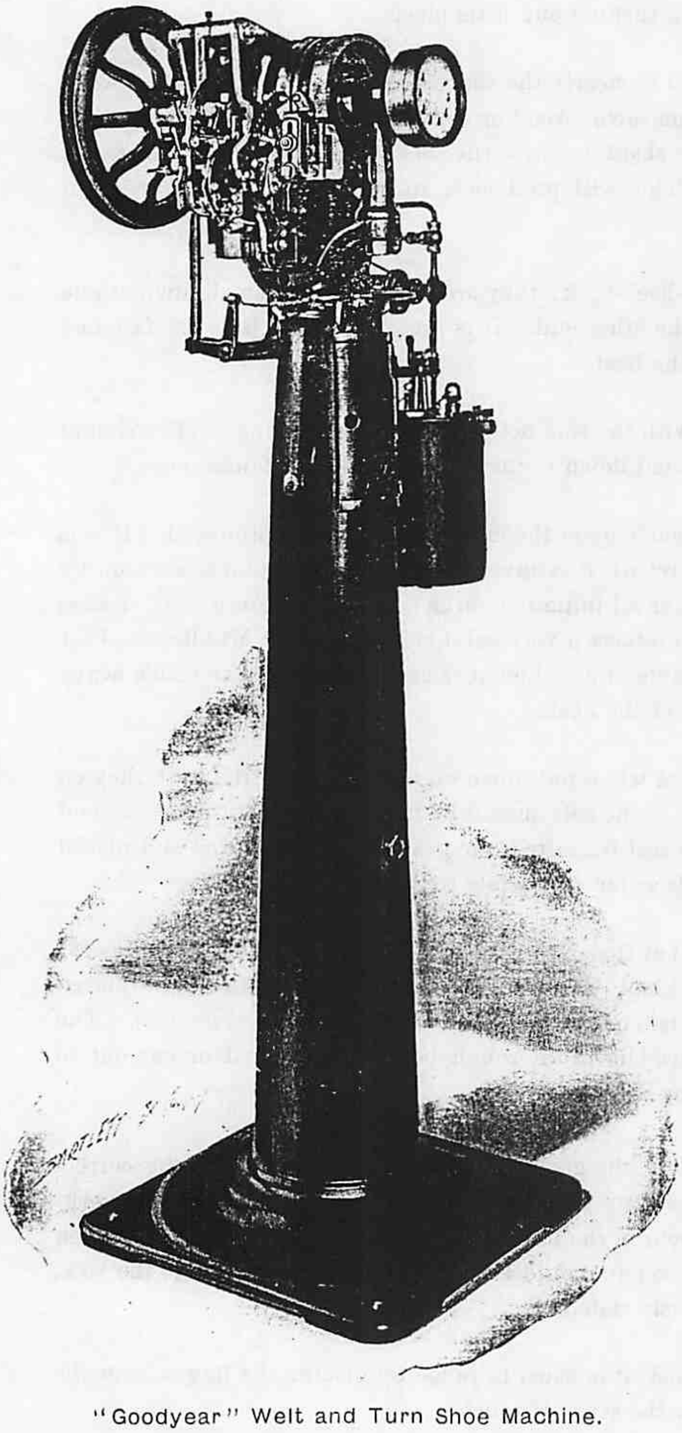
The soles may be laid automatically by machine, either by attaching with the " Staple Tacker," or by laying the sole by the " Sole Layer."

To face Page 176.

Plate 85.



"Goodyear" Lockstitch Welter.



"Goodyear" Universal Inseam Machines for Welting and Turn Shoes,

by

THE BRITISH UNITED MACHINERY Co.,

Union Works,

LEICESTER.

"Goodyear" Welt and Turn Shoe Machine.

(*See Plate 86.*)

"Goodyear Rotary Sole Laying Machine."—Plate 71. In using this machine, the outside of the filling in the bottom of the shoe each receive a coating of rubber cement. The shoe is placed on a jack which has been automatically presented to the operator, shewing the complete outline of the shoe so that the outsole may be laid accurately. The machine having been put in motion, the jack swings under the pad, which automatically seats itself on the outsole, and after the machine has described a quarter of a revolution, the full pressure is exerted directly on the sole. The shoe remains in this position while the soles of the other shoes are being laid. When the shoe again reaches its original position it is released automatically and presented to the operator with the sole thoroughly and evenly laid.

We may now consider that the soles have been laid either for welted work or for a through seam; if the middle sole was attached by the "Blake Sewer" or the "Standard Screwer," it would be necessary to slip the last before sewing, but the operation of laying the sole is sometimes performed without re-lasting the boot, that is, the sole set to the middle tacked on the wire grip and stitched or sewn, and passed on to the heelers. If we assume that the sole was laid in the rough, it would be now passed to the rough rounder and channeller—See Plates 90 and 93.

The channel laying would now be executed: this is apparently a simple operation, but it is of very great importance; the channel should be rubbed down accurately, the pressure required being more of a kneading nature than merely crushing; it is preferable that the channel be cemented down, there is no objection to cement in the presence of damp in the bottom stock, and if cemented in the stock-fitting room, they would be ready by the time they reach this operation.

Assuming the channel to be laid after the sole is attached by stitching, sewing, or metal fastenings, the next operation would be the bottom levelling; this is done by several different methods. By direct even pressure, by rolling pressure, and by a combination of rolling and pressing; these different types of levellers are shewn upon Plates 88, 90, and 91.

The action of the "Levelling Machine" requires some careful consideration; the result desired is that the sole shall be bedded down to the upper, and shall have the form required in the finished boot; unfortunately, although most of the apparatus bed the sole down, they also bruise the leather far more than it is desirable, and consequently, it is sometimes very difficult to get a reasonable finish upon the bottoms of boots that have been levelled by machine; there is not much doubt but that many levelling machines apply too much pressure.

Another point which is sometimes overlooked, is the fact that some levelling machines have a tendency to press the sole in some one direction, and consequently, the relation between the sole and feather of the insole is often spoiled. These defects can be prevented by the exercise of care in the application of the amount of pressure or the direction. This operation is frequently placed in the hands of quite inexperienced operatives, who cause much trouble in the finishing room.

Rounders and channellers consist of a chopping device that work at right angles to the sole, which is fed through the machine at a distance from the feather which is regulated by a guide under the control of the operator, who can vary the width of the welt at will. The machine follows the welt seam, and therefore faithfully represents the true shape of the boot. The sole is channelled to the rounding, and as both the rounding and the channelling correspond with the welt seam, this ensures

that the stitching does not cut the welt seam, and quite prevents the needle or the awl of the stitching machine striking into the seam previously made. This machine is really a labour saving device in addition to being very accurate.

The channel would be now opened by hand or by machine—see Plate 69, and in the case of a Blake-sewn boot the last would have to be slipped from the boot before sewing. The operation of doing this requires a little practice : the heel of the boot should be taken in the hollow of the thumb of the right hand, while the forepart is grasped between the thumb and fingers of the left hand ; the right hand now pushes the heel of the boot upwards and off the last. When the hollow of the leg at the back reaches the top of the last, it is liable to stick through the lining, catching in the back of the last ; the lining thould be eased over this portion. The heel is then again raised strongly, and at the same time the forepart is drawn forward with the other hand, when it will be found that the upper will slip off the last. The boot is now sewn or stitched ; if sewn, it would be upon the " Blake " or " McKay," which produces the loop-stitch shewn upon Plates 84, 88 ; if it is stitched, it is attached by a lock-stitch by the stitch shewn on Plate 84, and by the machines on Plates 87, 92.

The method by which upper-stitching machinery produce their seams is explained upon Page 124. But although the principle is similar in bottom-attaching machines, there are distinct differences in the method of producing the stitch. All chain-stitch machines make their seam with a single thread ; all lock-stitch machines use a double thread or two threads, which are interlocked to form the seam. One of these threads is carried in a shuttle and, consequently, its length is limited by the capacity of the bobbin. Therefore, as the chain-stitch machines make a continuous seam, which can be made as long as the length of thread on a spool, whereas, the lock-stitch can only make a seam as long as the shuttle thread. This causes some loss of time in the changing of the shuttle bobbins, which loss varies with the greater or less length of thread that the bobbin is capable of carrying. Broadly speaking, the chain-stitch machine is faster than the lock-stitch, and the lock-stitch machine is greatly affected as regards pace by the length of the shuttle bobbin. This is an important matter often overlooked when selecting machines.

At the same time the principle of the chain-seam makes it a more elastic fastening than the lock-stitch, and when used as a vertical seam, as in the " Blake Machine," it will seam together almost any materials. But the seam formed upon the needle or hook side of the material is a series of loops, and as the loops are laid on the outer sole, a much larger channel is required to cover the loops of the chain-stitch than to cover the seam of a lock-stitch. So far as the matter refers to vertical machines, the matter may be summed up by saying that the chain machine is faster, more elastic, but requires a larger channel than the lock-stitch.

The " Lock-stitch Machine " produces greater uniformity, it makes a neater and flatter seam, and with equal tension it draws the material closer together than the chain-stitch. It is certainly stronger or less liable to pull out. A stouter cord may be used in sewing the seam, and the needle does not require to be so large, therefore the hole made is smaller. It can be said that the lock-seam makes a stronger, neater, and more uniform stitch than the chain-seam.

The simplest illustration of the chain-seam is shewn upon Plate 84. It will be seen that the hook A draws the thread B through the material in the form of a loop, that the hook passes down inside this loop and draws another loop within the first loop made ; the drawing up of this latter loop

tightens the previous one made, and consequently there is a certain amount of friction in drawing the loop tight. The hook A has a vertical motion, the pointed head coming down within a whirl ; this whirl is a circular piece of steel, which is pierced to allow of the passage of the thread and the hook.

When the hook has reached its lowest point, a movement of the whirl carries the thread round the barb of the hook—see Figure 1. Upon the hook rising it draws the thread up with it, as Figure 2, and as the hook rises above the level of the work it draws the loop in its barb through the loop that it made previously, as Figure 3. The work is then fed the length of a stitch, and the hook again passes down inside its own loop and repeats the movement. In the latest machines there is a special device acting against the hook which holds the loop of the thread during the downward movement, but no great alteration has been made in the principle of this machine since it was introduced.

When this principle of making a seam is applied to a horizontal seam, as a welt seam, certain important modifications have to be made. The pull of the hook sideways against the seam of the welt has a tendency to draw it out, and the tightening up of the stitch pulling against the material makes it necessary to have better material than for a lock-seam ; this has led to the introduction of a special device for tightening the seam from the inner side, as shewn on Plate 84. This invention converts the strain from the outer to the inner side ; reference to the diagram may assist in the explanation of this.

As previously mentioned, the chain-stitch is tightened up by the next stitch made, and in the ordinary way would cause a tendency for the material to pull out in a welted boot. Figure 1 is a side view of the essential principles of the machine. F is a curved needle which moves in the arc of a circle and pierces the welt upper and innersole. G is a thread carried, which assists the special device for tightening the seam. Figure 2 shows the needle at its lowest point, and inside its loop the thread passing through the thread carrier G. H is the special device for tightening the stitch. While the seam is in this position the thread tightener H rises and draws the thread upwards from the innerside, as shewn in Figure 3 ; this upward strain tightens up the previous stitch made, drawing the slack from the inner side instead of the needle drawing it from the outerside. While held in this position the thread carrier G (Figure 3) makes a movement which carries the thread round the barb of the hook, as Figure 4, the stitch tightener retaining its position and further tightening up the seam. The needle then rises through the material, taking the loop with it ; the thread tightener and the carrier return to their original position, the work is fed the length of one stitch and the movement repeated. In these Figures A represents the welt, B the upper, C the innersole, D the inside channel, E the thread, F the hook, G the thread-carrier, H the thread-tightener.

The principle of the lock-stitch is explained upon Page 124, and the variations made are not sufficiently great to require a special description. The principal difference is in the character of the thread and in the pull-up and draw-down, as previously explained. Seeing that these machines are designed to carry a wax thread, and that the nature of wax is to set hard when it is cold, it must be evident that any device that has a tendency to deposit the thread in the work with the least probability of it getting cold is an advantage. It is also the nature of wax to lose much of its value if repeatedly heated above the temperature of boiling water, it is therefore a good point if the wax-heating apparatus is within a water jacket ; and it is a less desirable point if the gas jet is in direct contact with the wax pot. These are general principles which cannot generally be entirely applied to any one machine ; the special machines for sewing and stitching are illustrated upon Plates 85, 87, 88, 92, and 93, to which references will be separately made.

The condition of the sole during these operations is very important. The nature of bottom stock being rather harsh, and the character of wax in the condition of which it is in during the making of the seam, rendering it liable to be affected by friction, makes it necessary that the parts being sewn or stitched should be in as mellow a condition as practicable. Therefore, the work should be sent through without undue delay, or it will be necessary to damp the channels.

Sewing seams by a machine have from three to six stitches in the inch, stitching seams may be made in the stitch from the sixteenth-of-an-inch upwards.

The blocking of the bottom stuff is an important matter. As a general principle, it should have a little more curvature in it than the bottom of the last, so that on the sole being placed upon the upper and pressed across the joint by the hand, the other part naturally clings to the bottom of the sole. This would happen if the sole had a little more spring than the last, seeing that it would only be necessary to press the joint down for the other parts to cling to the bottom. With this natural cling of sole to the bottom part of the boot, a less number of tacks are required than if the sole was shaped in some other way. There are several machines used for the purpose of tacking on soles. The "Staple Tacker," Plate 81, which drives a staple and clinches the points on the inside. This machine works equally well on thin or thick work.

It is indispensable for really good work that the sole shall have either been blocked to the exact shape of the bottom before being laid, or that it should be bedded down to the upper during the laying. In machine-sewn work that is stitched to a middle, the sole should be a little fuller, to permit of it being trimmed-off square.

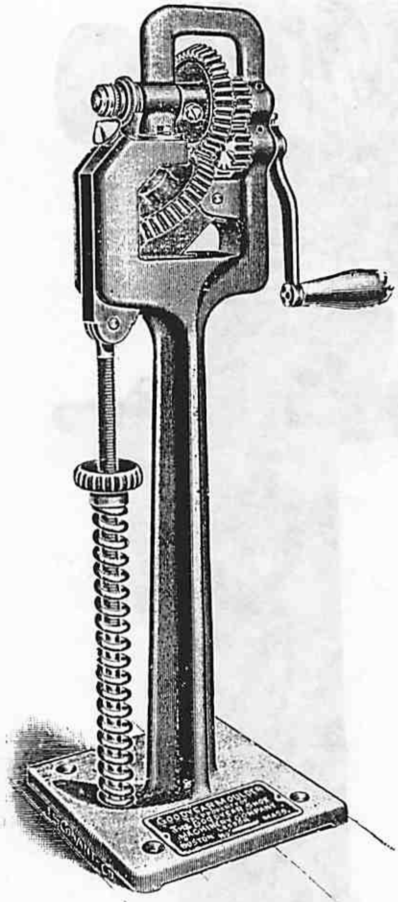
The number of seams in a boot and the nature of the attachment, decide the degree of flexibility. The actual bending of the boot is brought about by the parts sliding over one *another*; if the seams joining these parts are each flexible, a flexible boot is the natural result. Where several parts are joined together by different seams, there is naturally a probability of some of the seams admitting of movement, and consequently producing a more or less flexible boot.

Seams are divided into horizontal seams and vertical seams. Horizontal seams are seams that are level with the ground, as a welt seam, or a turn shoe seam. Vertical seams are seams that are upright from the ground as stitching seams, Blake seams, and rivetting seams. There is also some difference in the degree of rigidity owing to the nature of the fastening. A loop-stitch fastening is naturally elastic both in the arrangement in the boot, and the relation between the size of the needle hole and the thread. The lock-stitch is not so elastic owing to the lock of the threads in the centre of the material. Metal fastenings do not admit of much movement of the parts, and are consequently rigid. From this we get different degrees of flexibility in about the following order, the first example being the most flexible :—Turnshoe, single horizontal seam; Veldtschoen, single vertical stitching seam; Blake-sewn, single vertical sewing seam; Welted boot, horizontal and vertical seam; Sewn and Stitched, double vertical seam; Screwed and Stitched, combination of two vertical seams—metal and thread; Rivetted, single metal vertical seam; Screwed, single metal vertical seam; Pegged, single wood vertical seam.

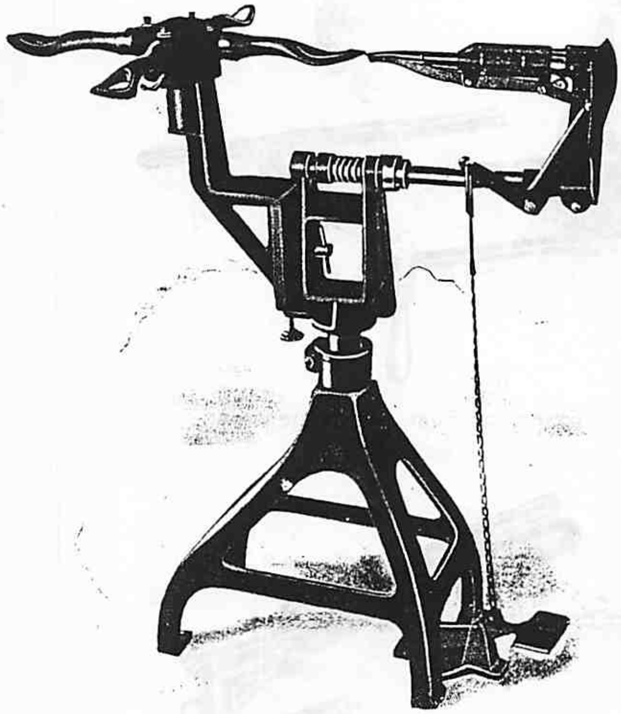
These are quite comparative and assume equal flexibility of the parts, or natural flexibility in the leather necessary for the attachment. Where one seam only is used, there is less liability of

To face Page 180.

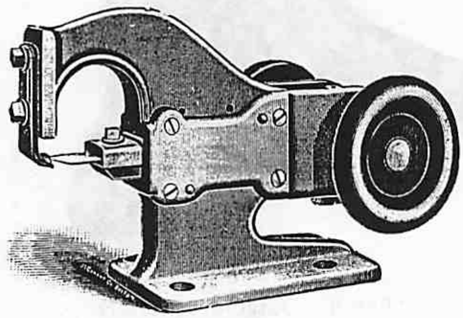
Plate 86.



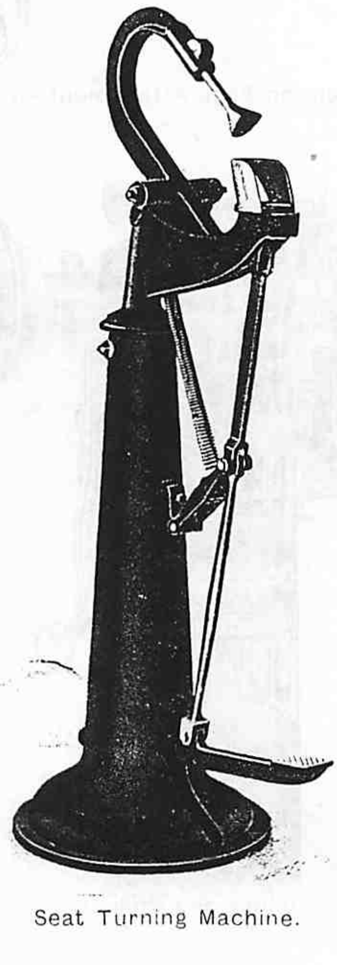
"Goodyear" Moulding Machine.



Forepart Turning Machine.



"Goodyear" Turn Shoe Trimmer.



Seat Turning Machine.

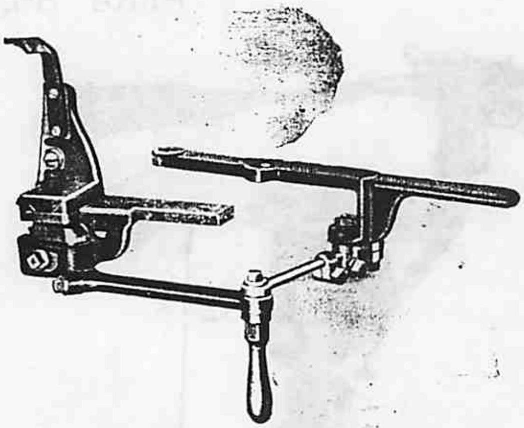
Turn Shoe Machinery, by

THE BRITISH UNITED MACHINERY Co.,

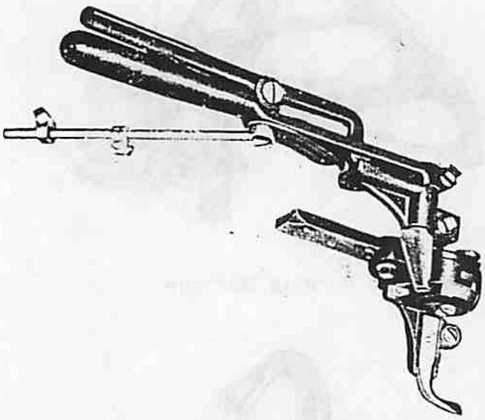
Union Works, LEICESTER.

(See Plate 87).

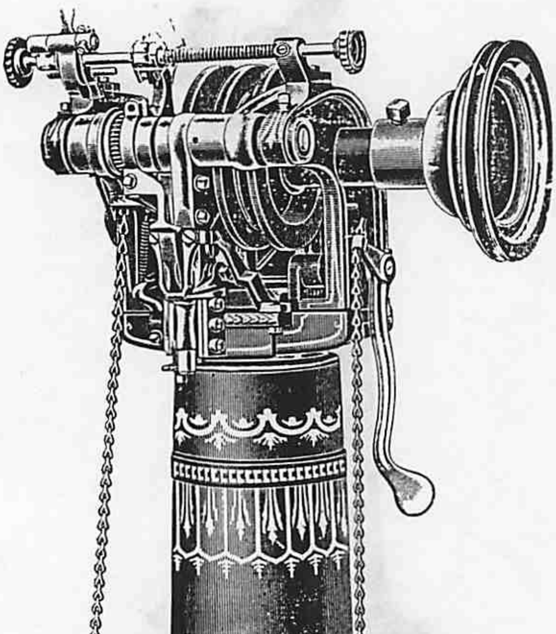
Plate 87.



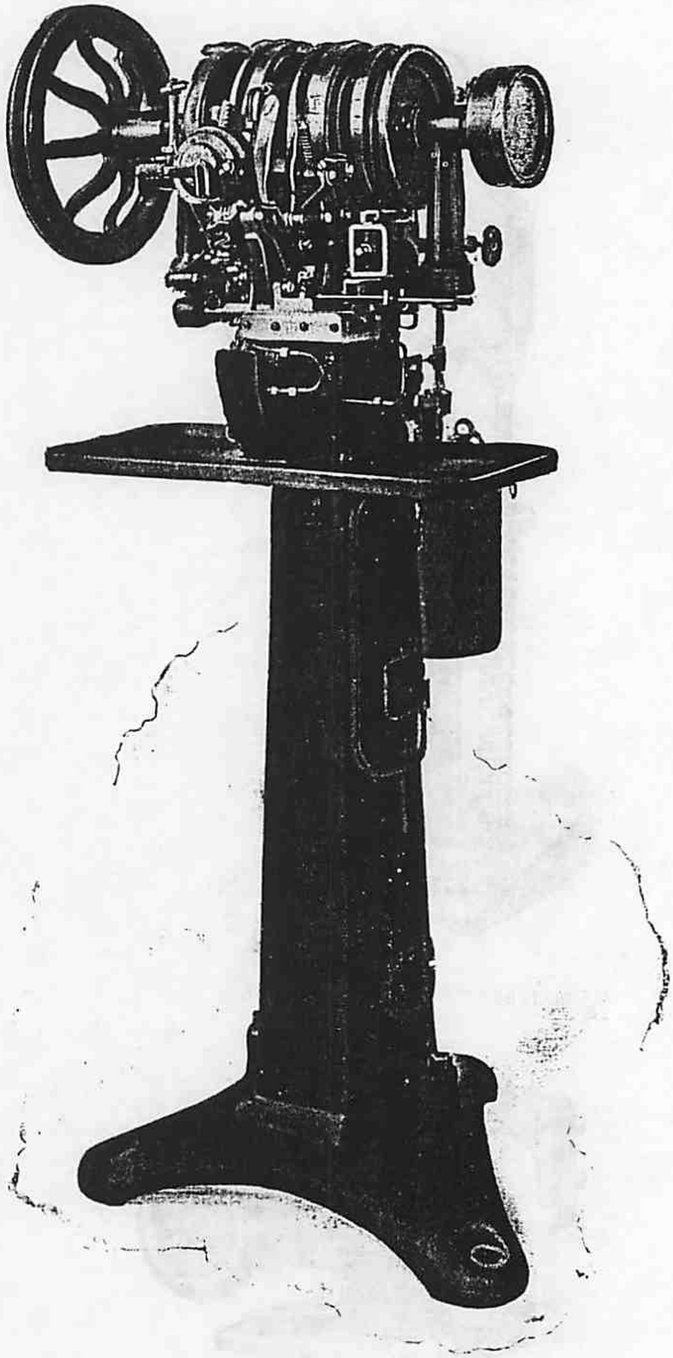
Extension Edge Attachment—A.



Extension Edge Attachment—B.



" Universal " Rounder and Channeller.



" Rapid " Outsole Stitcher.

Stitching and Rounding Machines, by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

(See Plate 88.)

movement, and if this seam is of a rigid nature, the result is the production of a rigid boot. The direction of the seam also affects the flexibility. Seams that are vertical with the ground, and which by their nature do not admit of much movement, as screws or rivets, naturally produce a stiff boot. Horizontal seams which do not resist bending in the direction in which they lay, and are consequently very flexible, as in the welted seam and in sew-rounds, are the most flexible known.

Mention has been made that a perfect reproduction of the hand-seam by a machine has not yet been accomplished. A plain hand-seam is shewn upon Plate 83, by which it will be seen that the thread goes alternately backwards and forwards through the leather. This is really a single thread seam, and in its simplest form is made without a lock; the fact that the hole made by the awl being less than the substance of the threads, makes the tension sufficient to hold the seam. Under some circumstances and for special purposes, this seam is locked upon one or both sides, as shewn upon Plate 67. It will be observed that the single lock is produced by passing the thread through the top loop of the previous stitch before pulling it in. The natural consequence is that the threads are interlocked upon the top surface: this may be repeated upon the other side and a double-lock produced. This form of sewing, however, is not by any means common, and is really of rather doubtful advantage; but in a degree it is a reproduction of the lock-stitch of the sewing machine.

Turnshoe work is lasted inside out, and sewn either by hand or upon the machine used for welted work: after sewing, the seam is trimmed and the shoe—after the last is withdrawn—turned. If turned by hand the heel portion is pushed out, and this is followed by the pushing of the front or toe portion. These operations may be performed by the machines: the "Goodyear Turnshoe Trimmer," "Heel-turning Machine," and "Forepart Turner," illustrated upon Plate 86. These machines perform the operation in the same order and in a similar manner to the hand worker. The "Heel-turning Machine," which works by foot power and is under the perfect control of the operator, first pushes the heel out. The shoe is then placed over the foot of the "Forepart Turning Machine," and as one portion passes over the other, the forepart is turned right side out. The shoe is then pushed into shape on the special feet attached to the machine, and afterwards re-lasted.

The Veldtschoen—one of the simplest forms of attachment—is produced by a method of turning the upper outward upon the flesh of the sole and fastening it by stitching. This is one of the simplest and most elastic forms of attachment, and is used with several variations. The process is very easily performed with the aid of a lasting machine, the wipers blocking the toe round the last in a very convenient manner. The practical details of this process are as follows:—The upper may be turned outward all round the edge of the sole including the seat, or it may be lasted underneath at the seat as in other work; if turned outward all round, the stiffening and back lining would first be drawn over the last and the sole placed upon them. The upper is then drawn over and tacked round to the edge of the sole; it is then bedded in along the grain edge, or welt edge of the sole, producing a ridge. The channel is then opened, and the stitching done upon an ordinary stitching machine. Most stitching machines are now fitted with a welt carrier for this class of work; this welt is simply a strip of leather sufficient to hold the stitch and form a better finish than could be obtained from the surface of the upper. If the seat is required to be lasted in, a short cut is made in the upper at the place where the edge of the seat is situated, and a short seat insole is put upon the last, and the seat portion of the upper and stiffening tacked to it. The sole is then laid down, the upper being turned from each corner of the seat, and the lasting carried out as described. Heels of the wedge type may be made by inserting split lifts or whole lifts between the seat formed by the upper and the sole.

If these seat pieces are attached to the insole, the seat of the sole may be stitched round to them ; but generally, the sole is attached by some wire method to the seat.

"Goodyear Welt and Turn Shoe Machine."—This machine sews the welt on the shoe, fastening together with a chain stitch the welt, upper and insole. It practically duplicates the work of the hand welt sewer. It measures the thread to the needle perfectly, thereby preventing all abrasion to the thread. After the needle has drawn the loop through the work, and has returned again through the stock, the take-up tightens the stitch by pulling on the supply end of the thread, while the needle firmly supports the leather between stitches against the sawing action of the thread. This is the only method yet discovered for tightening the chain-stitch without destroying the "between substance." The chain of the stitch is placed on the outside of the welt, or, in the case of the turned shoe, on the outside of the lining of the upper (before turning). This method of forming and tightening stitches gives a perfect result.—Plate 85.

"Goodyear Universal Inseam Sewing Machine."—This is a machine for sewing on welts, and also for the sewing of turned shoes, It is a shuttle machine, forming a lock-stitch. Every stitch is locked and crossed in order to make a heavy, tight seam, and in general features many of the best characteristics of the "Goodyear Outsole Rapid Lock-stitch Machine" will be found in this machine, so far as concerns the handling of the thread free from abrasion and with perfect measurements. In many respects the work is similar to a hand-sewn seam. It is more uniform however, and very much tighter.—Plate 85.

"Goodyear Outsole Rapid Lock-stitch Machine."—This machine fastens the outsole to the welt with a lock-stitch seam. A sufficient amount of thread to form each stitch is accurately pulled from the wax pot, this being automatically controlled according to the amount of thread needed. The stitch is perfect, and the regulation of the feed is under instant control of the operator. It will stitch the lightest or the heaviest sole with equal facility, and there is plenty of room for the operator to manipulate the shoe.—Plate 87.

"Goodyear Universal Rounding and Channelling Machine."—Plate 87. After the outsole has been laid by the "Sole Laterm," this machine rounds and trims off the surplus welt and outsole stock, at the same time cutting the channel as may be desired. Either blocked or dyed stock may be used. As the machine automatically shapes the sole and cuts the channel, gauging from the edge of the last, the Baltimore Extension, Scotch Edges, or any special shape desired, may be accurately obtained. This is one of the most important machines in shoemaking, as the general style and character of the shoe is given in rounding. In one operation it simultaneously rounds channels and automatically shapes the sole.

The distinction between the various seams is illustrated upon Plate 83. The seams formed by threads do not require further description, but the screwing seam illustrates another principle of attachment. The strength of this method depends upon the character of the screw and the nature of the material. It must be evident that if the screw is not correctly formed, that it will not hold in the material, particularly under the peculiar strain that is applied to a fastening in a boot, and the material must be sufficiently solid to hold a screw, for satisfactory results to be obtained. These screws are made single or double-threaded ; the double-threaded screws are used upon fast machines, with stationary heads ; the pitch of the screw, single thread, is usually about the 24th-of-an-inch, which would make a 48th-of-an-inch for the double threaded.

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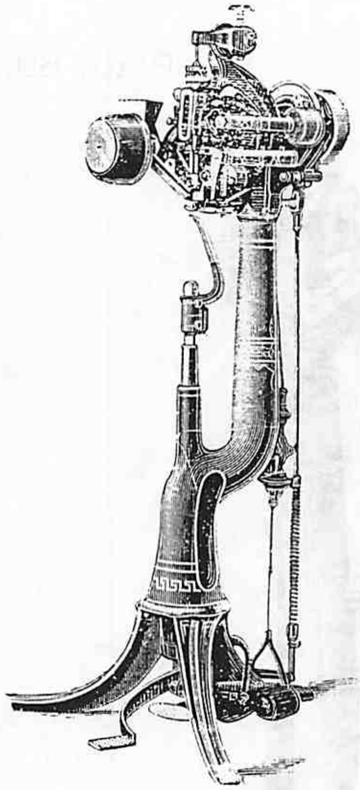
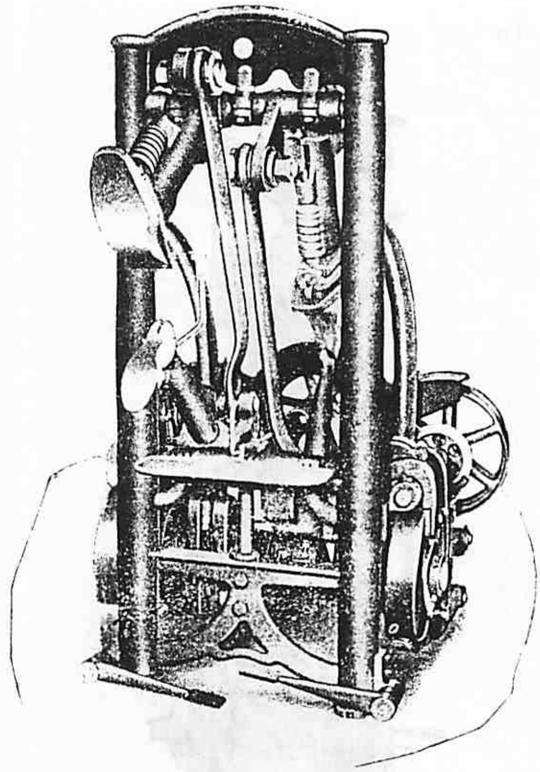
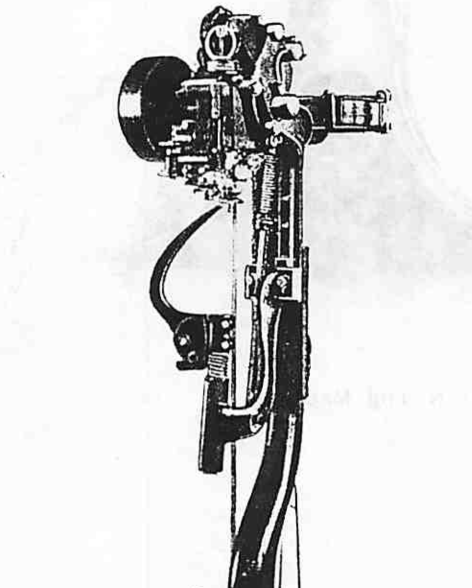
Plate 88.



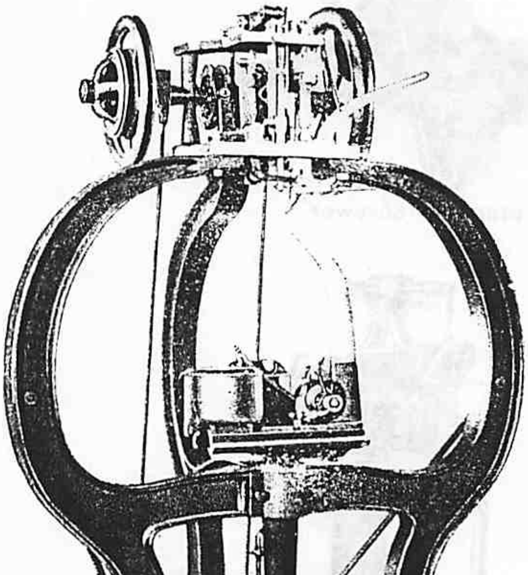
Loose Nailing Machine.



"Hercules" Levelling Machine.



Double Clinch Staple.



"McKay" Sole Sewing Machine.

Sole Levelling, Fastening, and Sewing Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

(See Plate 89.)

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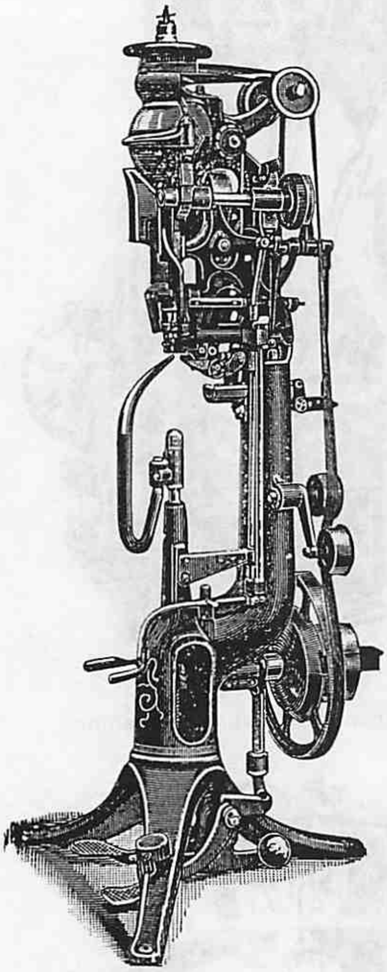
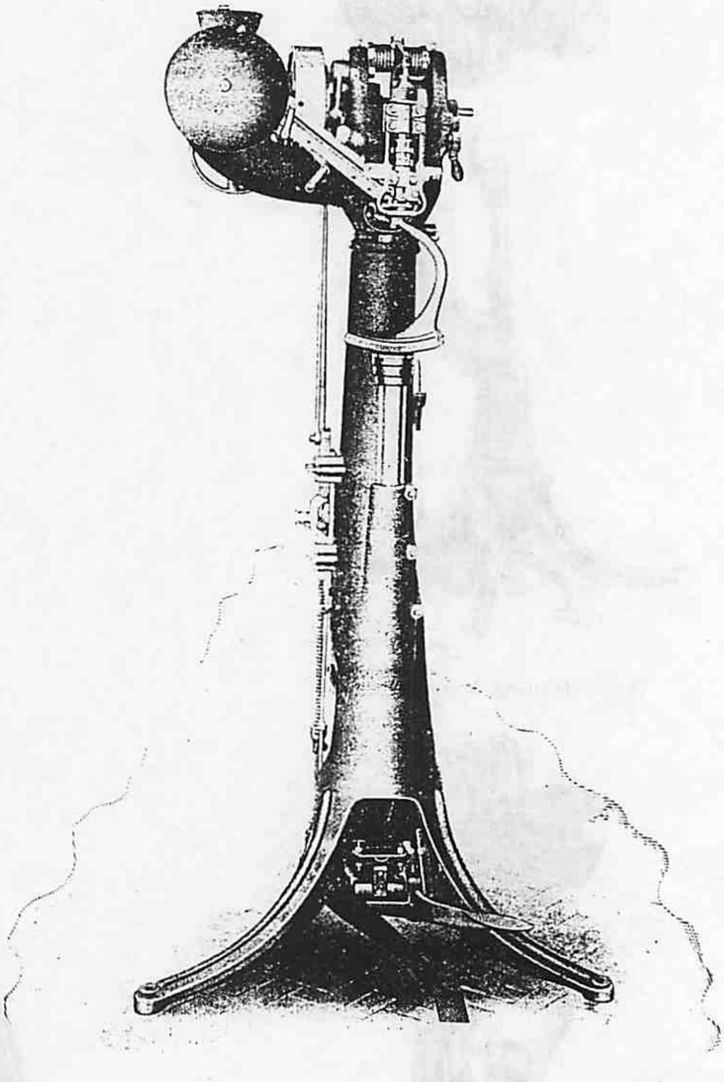
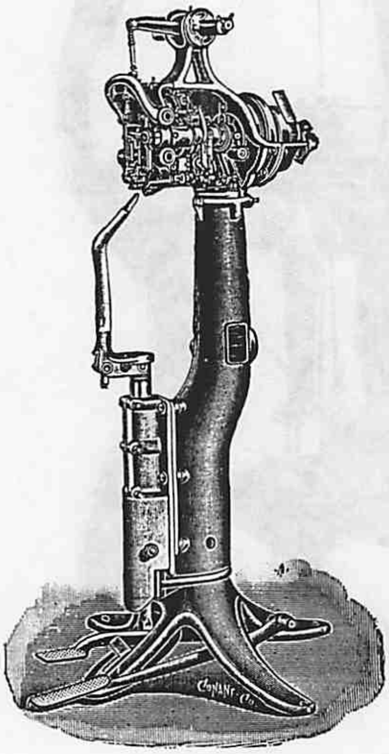


Standard Screwer.



Hob-Nailing Machine.



"Davy" Pegger.

Screwing, Pegging, and Hob-Nailing Machines,

by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

(*See Plate 90*).

The "Standard Screw Machine" was one of the first advances made in the direction of metal fastenings, although several efforts to produce a metal fastening had been attempted. The original machine had a moving head which was raised by the operator through the action of a treadle; the boot was placed upon a horn similar in shape to the "Blake" horn. Upon the treadle being released and the head descending, the nipple at the end of a spindle held the boot. Upon the operator starting the machine, a screw was driven through the work, being automatically cut off by the machine. The latest machines have a stationary head and gripper wire feed, and are very much faster than the original pattern. Illustrations of these machines are shewn on Plates 89 and 94. The machines will space the screws from a quarter-inch to half-inch apart.

"Rapid Standard Screw Machine."—This machine produces the strongest sole fastening. The wire is double-threaded and automatically measured. It is a genuine screw, fastening heel seats and also for toes of boots and heavy goods of all kinds. Average speed 250 screws per minute. The wire is made by a most expensive and scientific process, and the thread has perfect walls and a perfect pitch.

This machine is well known in every shoemaking country all over the world. The patent standard screw wire is placed on the machine in long coils. The machine screws the wire into the sole and cuts it automatically. The standard screws vary automatically in length, and every screw is of exactly correct length to suit, and firmly unite the substance worked upon. The inner sole being left perfectly smooth, the machine is made to feed so as to space the screws from a quarter-inch to half-inch apart at will. Heels may also be screwed on, or the seats of welted boots may be screwed without removing the last.

The rivet represents another principle: in this case the materials are held between the clinch of the rivet upon the insole, and the head of the rivet upon the outer sole. All wire fastenings are upon the same principle, but without the head. These rivets have usually a stamping in the form of a screw at the side, and are sometimes called screws by the operatives, but they are not actually screws.

"Loose Nailing or Rivetting Machine"—see Plate 90. The work done by this machine is more regular and solid than hand-rivetting, and no hammering of the sole is necessary afterwards. Each rivet is firmly clenched and the insole left perfectly smooth. The rivets may be of any length and are driven at the rate of 350 per minute, the distance between being regulated as required. Waists and foreparts may be rivetted in any style, and the machine is also used for attaching heels, rivetting top pieces, and fastening seats. The work may be done either on a jack with the last left in the boot, or on the horn after the last has been withdrawn.

The staple represents another form of attachment, and really includes two rivets which are connected upon the side usually occupied by the heads. It is difficult to conceive a more solid form of attachment than this.

"Universal Double Clinch Machine."—Plate 88. This is an entirely new machine, which is designed to take the place of the "McKay Sewing Machine," furnishing the manufacturer a fastening, the strength of which can be absolutely depended upon, in place of the weak McKay sewing. It also gives a much smoother outsole and insole, with greater flexibility. A steel wire, taken from the coil and corrugated in the machine, is used in forming this fastener, which is so driven that one end is

clinched back into the leather of the insole in a cup centre on the horn, over which the shoe is placed, while at the same time the driven end is clinched into the leather of the outsole, forming a fastening absolutely secure. It is also adapted for the purpose of nailing toes and heel seats, and, as a sole fastener on women's work and light and medium men's work, is unsurpassed for durability.

All these "Staple Tacking Machines" make a fastening similar to that described. These fastenings are automatically made from a coil of wire, and the peculiar form of each fastening is such that it becomes a pivot on which any portion of the sole turns when bent, as in walking.

The insole is left perfectly smooth, and a great advantage is the absence of wax on the insole. Another great advantage the machine offers is, that no channel is required to be cut in the insole whereby a considerable saving is effected, and there is a further economy in there being no channel flap to be laid after the soles are attached.

The finished boots have the same neat appearance as Blake-sewn work, and the fastenings do not appear on the surface of the insole, for as each fastening is inserted, the machine cuts and raises a small lip, which is laid flat and level with the surface of the outsole immediately after the fastening is inserted.

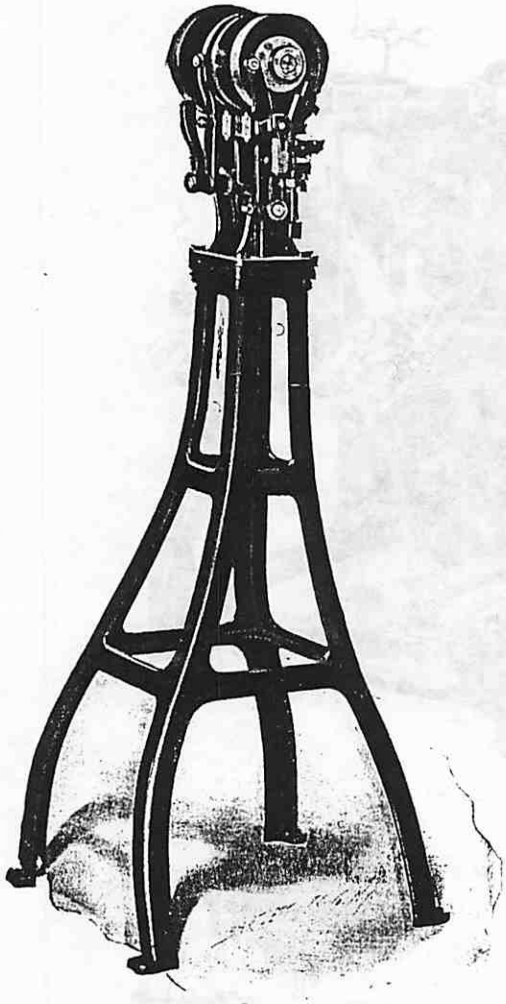
The "Staple Tacker," Plate 81, is the most recent production. It cuts points and forms its own staples from a coil of wire, the length of the prong being adjustable. The staples are used for all purposes for which machine tacks are used, and also for driving into the channel for strengthening "Blake" sewing on spike toes, and for attaching the sole up the front of the heel on "Louis" work.

"Staple Fastening Machine Outsole Layer."—This machine is used for practically the same purpose as the "Taper Nail Tacking Machine," but makes its own nail from straight wire. It forms a two-pronged staple, the loop of the staple coming on the outsole of the shoe, the two points clinching on the insole, and for very light outsoles is much preferred on account of the holding quality of the fastening. It is much used for nailing the pointed toes of the McKay sewn shoes. It is also largely used for reinforcing McKay sewn shoes and nailing heel seats on women's work. This machine must not be confounded with the "Automatic Staple-Nailing Machine."

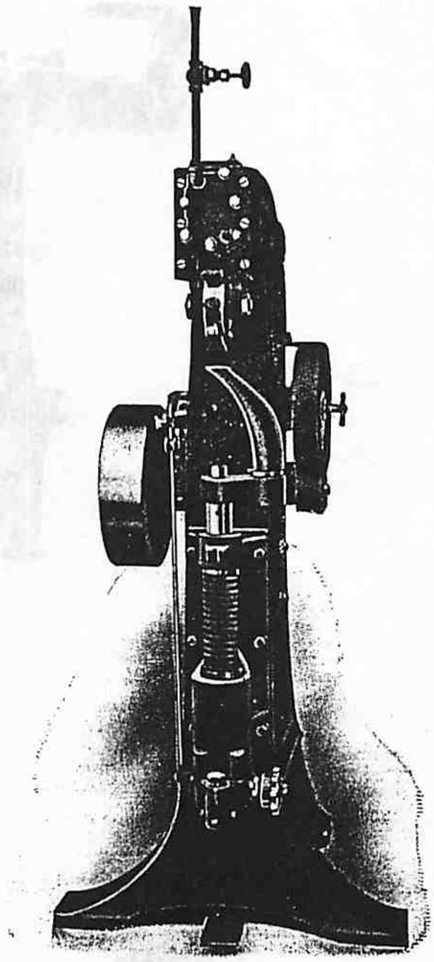
Non-metallic fastenings are undoubtedly an advantage for work that is subjected to extremes of climate. For very wet climates, or for conditions under which the boots are subjected to a great deal of moisture, there is no doubt that a wood fastening, as pegging, is most suitable. It appears that the swell and shrink of the materials under these conditions is more uniform between wood and leather, than between other methods of attachment. The pegging process by hand is a slow one, and the introduction of a machine was an enormous advantage. The pegging machine does something more than the hand worker, it makes the pegs from a coil of peg wood, drives them up to their heads—no hammering being required—and cuts them off on the insole, leaving a perfectly smooth inside. The pegs are driven at the rate of 600 per minute. For heavy water boots, fishing boots, or seaman's boots there is no better fastening. The capacity of the machine is not limited to pegging on soles, it is within the writer's experience that it is also capable of attaching heels.

"Davey Pegging Machine."—There are cutting devices mounted on the tip of the horn and operated automatically by mechanism, which cleanly cut off the projecting ends of the peg on the inside of the shoe as fast as the pegs are driven. The pegs are driven in a diagonal form, making a

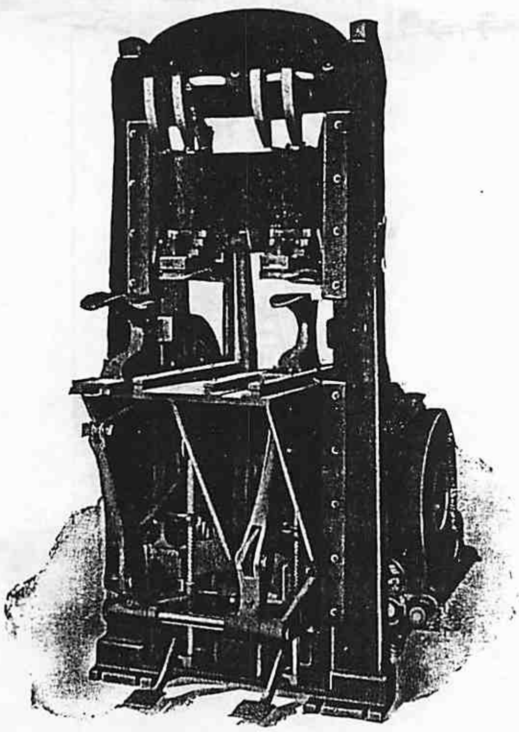
Plate 90.



Shank Skiving Machine.



Monogram Machine.



"Atlas" Sole Laying Machine.

Shank Skiving, Sole Laying, and Sole Stamping Machines,

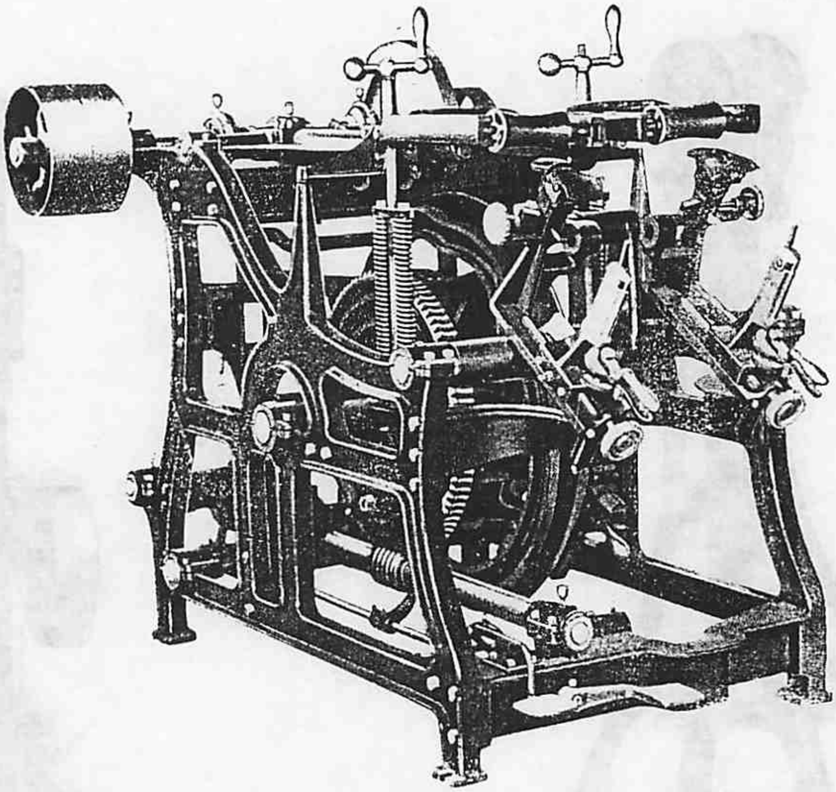
by

THE BRITISH UNITED MACHINERY Co.,

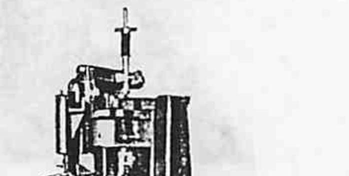
Union Works, LEICESTER.

(See Plate 91).

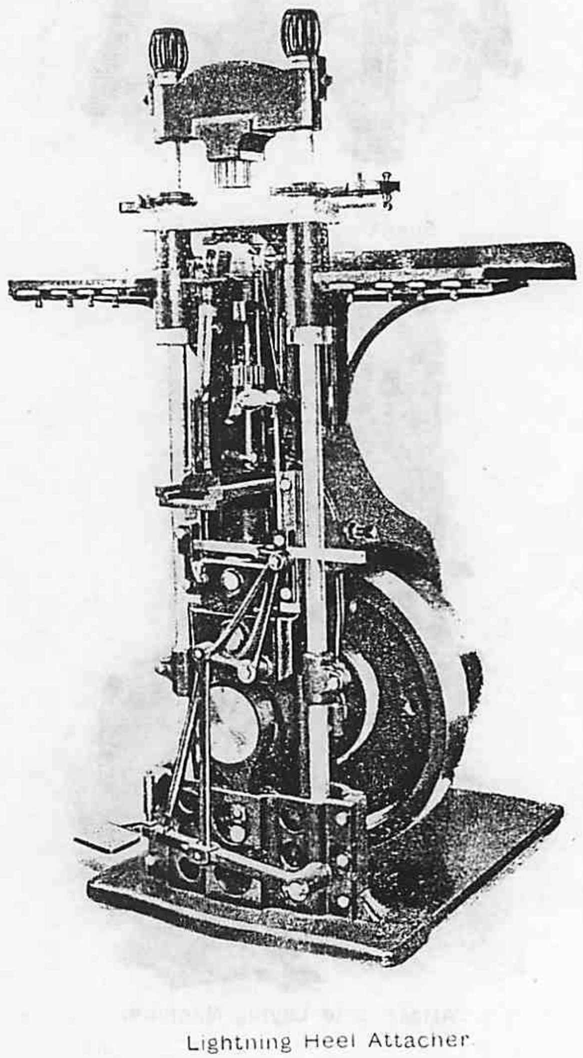
Plate 91.



Automatic Sole Layer.



Power Breaster.



Lightning Heel Attacher.

Sole Laying, Heel Breasting, and Attaching Machines, by

THE BRITISH UNITED MACHINERY Co.,

Union Works, LEICESTER.

(See Plate 93).

very handsome and regular seam. A special feature of the machine is the automatic device for making a peg of the same uniform size, regardless of the wear of the feed-cutting mechanism. The spacing varies from three pegs in one inch to eight in one inch, and any size or length of peg may be driven, varying from No. 10 to No. 18. This machine drives one row of pegs at a time. A two-row and also a three-row gauge is furnished with each machine, and by adjusting the gauge, the operator can drive additional rows of pegs as required. For pegging across the butts of taps a special guide is furnished.

These machines are now used very extensively in the United States. The average operator can peg 600 pairs per day. The form of peg wood used is that which has always been in use on the old style peggers. Not the least of the economical advantages to be obtained is the lasting of the boots or shoes on lasting machines with tacks instead of pegs. There are different styles of horns used, according to the grade of work, from the heaviest boot horn to the smallest shoe horn.

"Slugging Machines" are practically machines for driving shaped metal wire into the solid leather; the wire may be almost any shape in its section, this being merely a matter of expense, and the shape of the carrier or feeding apparatus. Some classes of machines drive a wire which is oblong in shape, and in which the greatest width of its section is in the direction of the feed of the boot. Other machines drive a wire in which the longest cross section is at right angles to the feed, and by the same argument as was used in reference to needles, a greater number of slugs can be put in across the line of direction than when they are the other way.

These machines usually cut off the length of wire, and afterwards drive the cut piece. The cut-off may be in the form of a point or square, according to the shape of the cutters. For slugging heels the shape of the cut-off is of less consequence than the length of the slug. For slugging soles the pointed slug appears to be more liable to be worked back than the slug which has its full substance driven right through. Most of the machines have a pricker which makes a hole, into which the slug is driven. This pricker generally acts as a feed; by this means it is possible to drive slugs in a variegated pattern over quite a large surface. Other machines feed by the action of a feed bar at the side of the driving apparatus, this is very convenient for driving the slugs at a regular distance from the edge, but presents some difficulties in wire quilting. Slugging machines are shewn upon Plates 73, 94, and 107.

"Universal Slugging Machine."—Plate 73. This machine is used for top lifts of heels, either on or off the wooden last, using various kinds of wire, either round, rectangular, square, diamond or fancy shapes, as may be desired. It is also employed for slugging two rows all around the top of a sole. It is an awl-feed machine and gives perfect spacing and alignment, leaving the work flat and as smooth as when it goes to the machine.

This machine is also used for quilting the bottoms of shoes in various special designs, in which case it must specially be fitted, and design cams are furnished for this work.

The different types of levelling machines are fully illustrated by the British United Machinery Company—"Atlas," "Hercules," "Acme," and "Auto" levelling machines, shewn on Plates 88, 90, and 91.

The "Atlas Levelling Machine" is a direct vertical pressure machine, in which a pair of plungers force a mould of the shape of the bottom of the boot, against the boot which has previously

been jacked. The jacks or feet move in a slide and are drawn forward to have the boot placed upon them; they are then pushed under the machine, which is brought down by the action of a foot treadle. This direct pressure compresses the sole against the foot portion of the jack and ensures a perfect blocking—see Plate 88.

The "Hercules Levelling Machine"—Plate 88, is also a direct pressure, but applies the pressure with a kind of rolling motion. It consists of a pair of jacks, upon which the lasts are placed; moulds are attached to a crank action above the machine, so that upon the movement of the machine the heel portion of the mould comes down upon the heel portion of the boot; the whole is then swung back, the pressure being distributed over all parts of the bottom. The machine moves alternately, so that as one boot is under pressure the other is being removed from the jack and replaced by another boot. It is a very rapid and efficient machine.

The "Acme Leveller"—Plate 90, levels the boot by a rolling motion, which is under the control of the operator; this rolling motion is applied by a series of vibrations very similar in their effect to the sleeking of the bottom by the hand worker. With moderately intelligent operation this machine should produce work equal to hand work; it is of very great assistance in laying down the channel and generally in getting the bottom ready for the next processes.

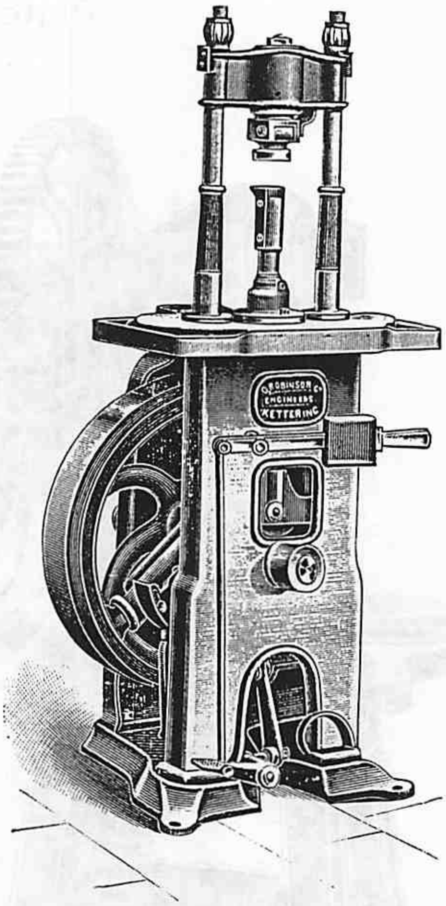
The "Auto Leveller"—Plate 91, is precisely what its title indicates; it automatically rubs down and sleeks the bottom of the boot; this it effects by a number of short vibrations by rollers, which automatically vary the position of their pressure, and the direction with the curves of the bottom of the boot. The boot is jacked by the operator upon a lasting jack, with toe support very similar to the jack used in lasting ordinary welted work. The boot is then swung into position under the rollers, which, by the movement of a pedal, immediately automatically level the bottom. The whole of the working parts have adjustments which enable the operator to modify or increase the action of the machine, according to the requirements of the work. It is a most efficient machine and exceedingly rapid.

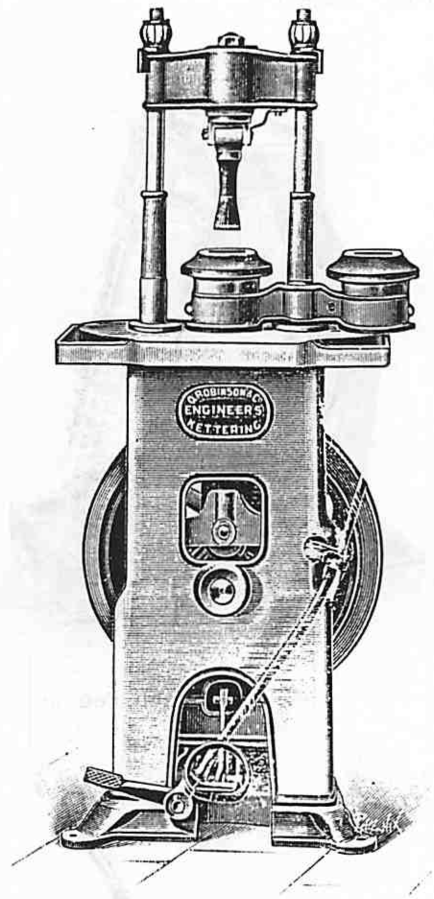
There is some difference of opinion respecting the order of the processes at this stage. By some methods the boot would now go to the heeling department. This is the usual system adopted for ladies' work; for men's work it has been found that there is some advantage in trimming the edges before heeling the boot. If we assume that the work being considered is men's work, the boot would be first trimmed along the edges. For an explanation of this process, reference must be made to the Chapter on "Finishing."

A description of the attachment of blocked heels was given on Page 155. A very similar method is adopted when attaching covered wood heels. The heel is first attached, either by blinding or cementing, and then the sole having been skived in the manner described, is brought up the front of the heel and over the top. The top piece is then attached and the boot slipped; the heel is then solidly attached by nailing from the inside. Machines are specially constructed for driving these nails; the general principle is to drive several long nails down the deepest part of the heel, and a row of shorter nails round the side, where there is not sufficient depth to take a long nail.

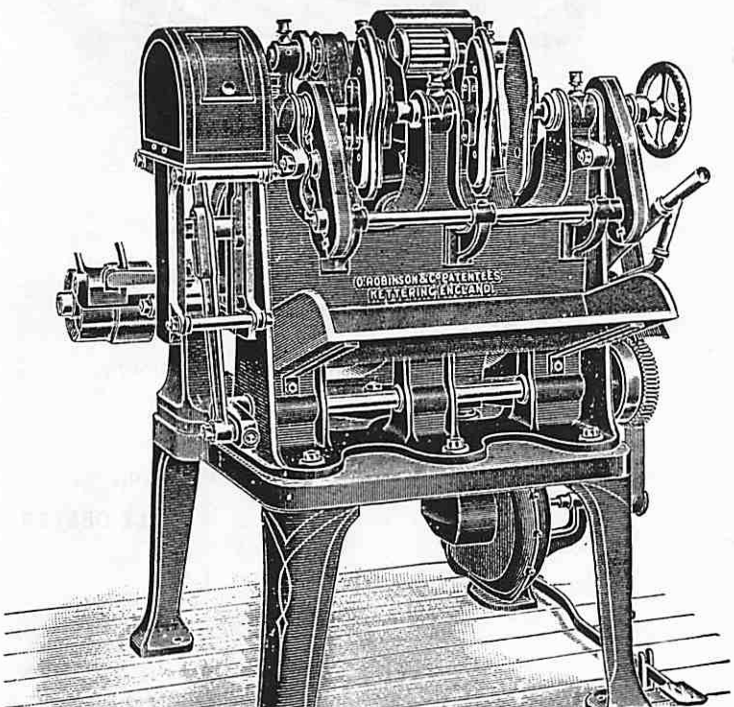
Another class of heel of a similar construction is made by placing the heel lifts underneath the sole, that is, bringing the sole up over the top of the lifts instead of underneath. These are made

Plate 92.





Heel Building and Attaching Machinery.



The "Champion" Sole Rounder.

Heel Building and Attaching and Multiple Sole Rounding Machinery,

by

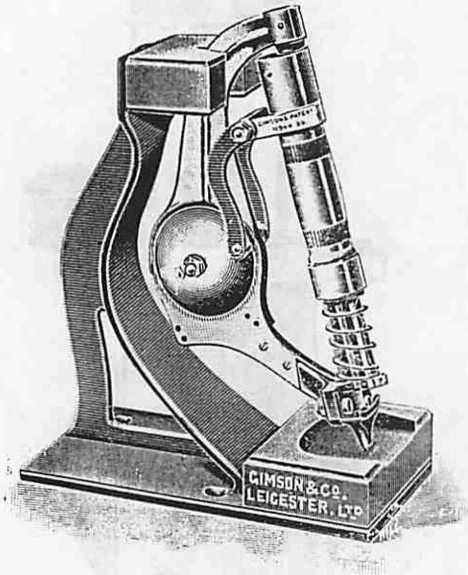
Messrs. ROBINSON & Co.,

Champion Works,

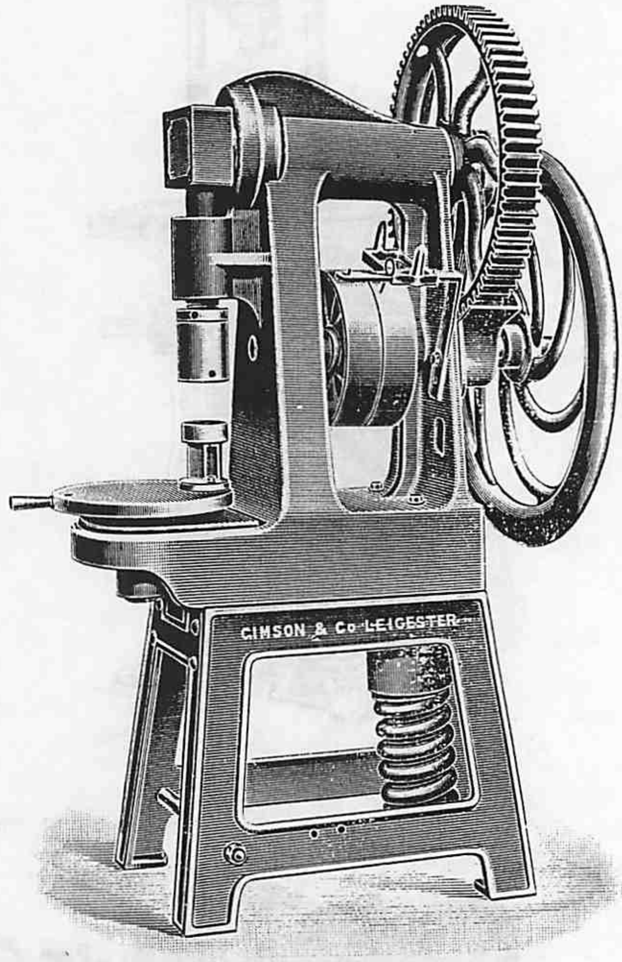
KETTERING.

To face Page 187.

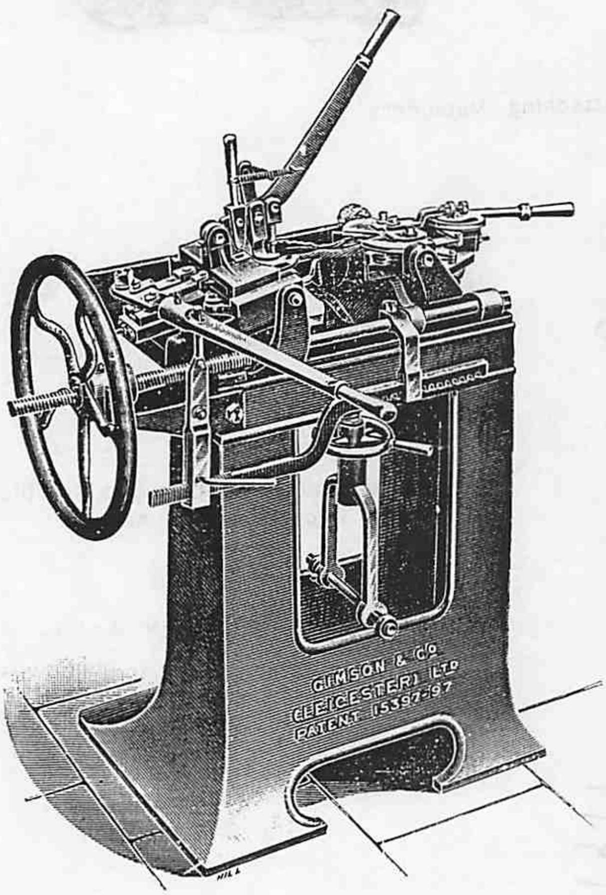
Plate 93.



Hand Tacker Feeder.



Heel Attacher.



"Fergusson" Lasting Machine.

(See Plate 94).

Lasting and Heel Attaching Machinery,

by

Messrs. GIMSON & Co.,

LEICESTER.

in various heights, from a single lift up to about half-an-inch high. The heel lifts should be skived off where the sole comes up over them in the form of a wedge, in fact this gave the original name to the heel ; they were called wedge heels, but are known under various names at the present time. For manufacturing purposes the heel may be attached by any of the wire fastenings. The sole is then brought up and attached by the "Staple Tacker" or any light tacking machine.

The different forms of heels are shewn upon Plate 96. Figure 1 is an ordinary built square heel, as usually produced for men's work ; Figure 2 is the same class of heel for a lady's boot; Figure 3 for a child's ; Figure 4 has the heel slightly more curved, this is known as a military heel. Where the top piece is brought out in a curve, while the seat is kept the same shape, it is called a floated top piece : if the breast of the heel is curved, as Figure 6, it is called a swelled seat : this heel would be referred to as a military heel with swelled seat. If in addition to the swelled seat the top-piece was also floated, it would be considered a half Wurtenburg heel. These are sometimes built of lifts and are referred to as built heels, as Figure 7. If the sole is brought up the front of the heel the breast has to be shaped as described for a Louis ; they are then built Wurtenburgs. In some cases the cover of the heel is sewn round the seat, the wood heel placed inside, the cover drawn over and the sole brought up the front ; the cover is then stitched to the sole : this heel is called a stitched Louis. Heels of this appearance are made with the stitch already formed. The cover of the heel is first stitched on an ordinary machine in the colour that is desired to show, the cover is then stuck on to the heel, the stitching being drawn into the correct position. They are attached as other wood heels, and the sole is drawn up the front and kept in place by a few tacks driven in a fine channel. The remainder of the process is as described before. Wedge heels, as previously described, are illustrated by Figure 10.

Machine methods of attaching heels are usually divided into two distinct styles—inside and outside attachments, although several systems are a combination of both these principles. By outside attachment the boot may be heeled upon the last ; by inside attachment the last must first be slipped. Generally speaking, ordinary men's work is attached from the outside, and ladies' work from the inside.

Ordinary square built boots may be attached from either the inside or the outside, but where there is a great deal of curvature in the heel, the pins used in attaching must either be of different lengths as previously described, or the lifts nearest the seats must be attached from the inside, and then the rest of the heel from the outside, though of course both these attachments might be made from the outside.

In very heavy work that have large metal tips or plates, the heel is commonly held together by the tip nails. By some methods the heel is built by the tip nails, and the attachment done from the inside ; but generally speaking, the heels of men's work are attached from the outer side.

The "Standard Rotary System," which consists of eighteen distinct machines, is illustrated here by the set which is most closely connected with the attachment of the bottoms by the welted system, and the processes for stitching, screwing, and slugging ; the systematic arrangement of this system is shewn upon Plate 98.

The "Standard Rotary Insole Channeller" has a fixed head in which the whole of the knives and feed wheel remain stationary, and a table which moves to allow for different thicknesses of insoles, the idea being to produce a lip and channel of absolute uniformity.

The "Lip Turner" consists of a rapidly revolving wheel which beats up the lip while the edge of the insole is held firmly under a feed wheel.

The "Chain Welt Sewer," illustrated on Plate 95, carries the usual curved needle, and has a separate pull of the thread located so that the strain on the thread has a tendency to produce a narrow seam—that is, the pull-up is entirely inside the toe and against the channel guide. It is claimed that the use of the looper only without a thread finger makes the machine superior to anything else for spiked-toe work. The average capacity is 250 pairs per day, although many more may be done. The wax pot is located as close to the work as it is possible to get it, consequently, the machine fills the seams well with wax, and the thread is led to its position before it has time to become perished. The whole of the actions of the machine are positive, being moved by cams. The awl moves in the same path as the needle and not in a larger curve as is usually the case. These points make the machine easy to operate.

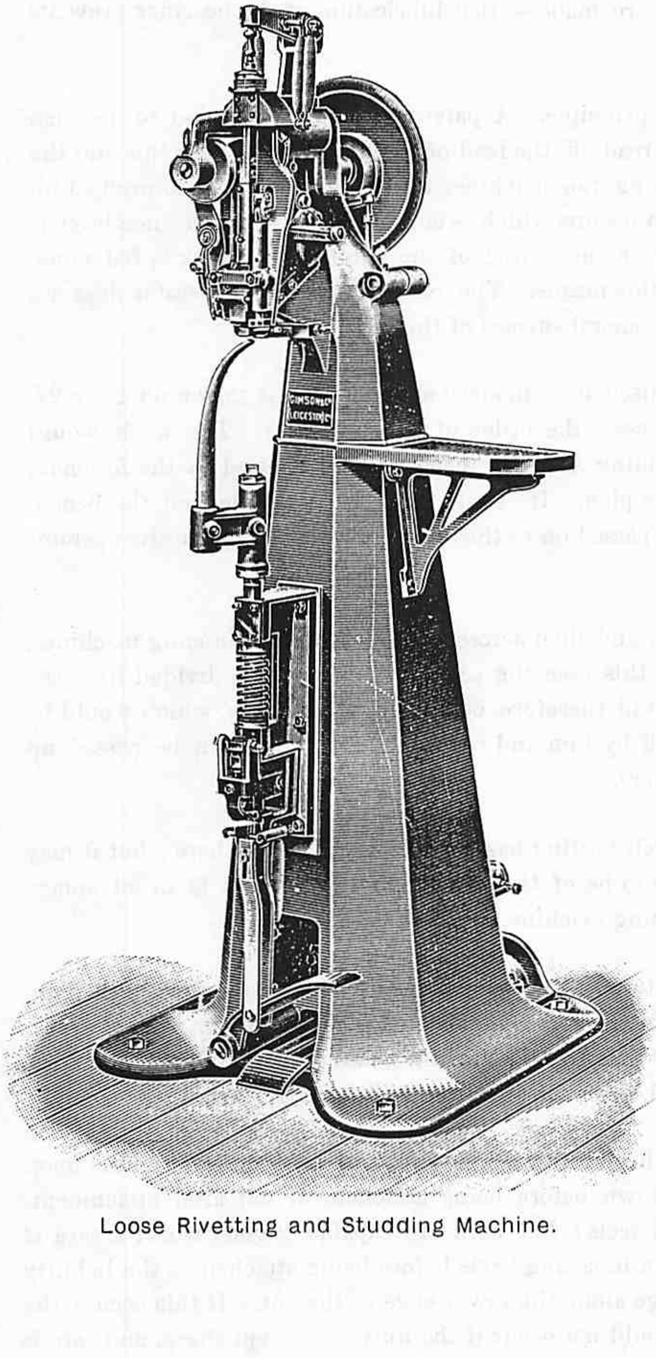
The "Sole Layer" is automatic, and carries four jacks; it is so arranged that three are under pressure; the operation of the treadle causing one of these to drop out ready for the removal of the shoe, while the operator is putting the next one under pressure; Rounder and Chaneller performing both operations simultaneously. Its special point is that it will feed equally well, whether there is no leather to remove, or whether the sole is much larger in size. The trimming knife is designed to effect the feed itself, the channel knife having no motion given to it. The edge gauge is operated to produce the Scotch edge automatically. When the machine has been set for a particular shape it will produce this shape with regularity.

The "Channel Opener" is on a new system, it consists of a revolving tool on a vertical spindle, to which the sole is fed; the tool is of the simplest possible character, and automatically turns the lip of the channel back preparatory to the machine sewing.

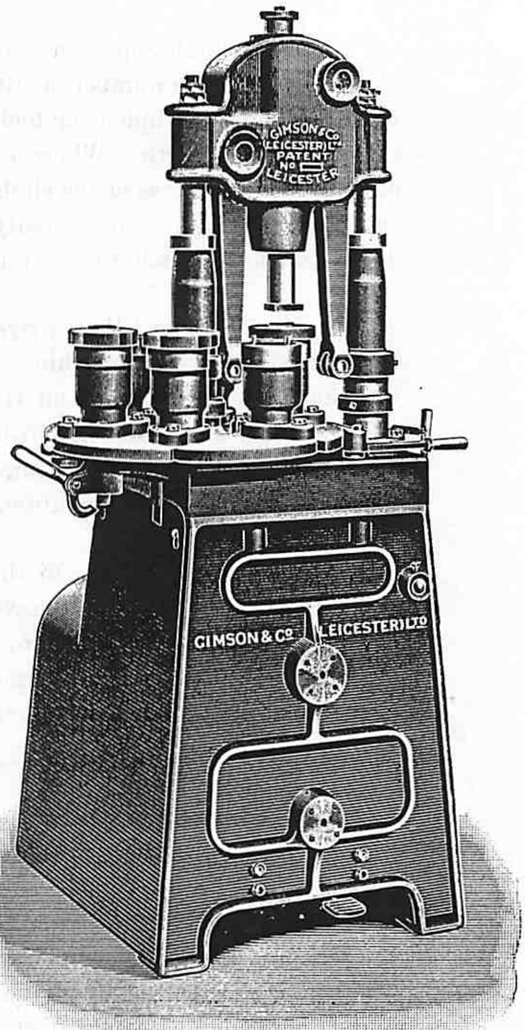
The "Stitcher," illustrated on Page 96, while it necessarily has a curved needle, possesses several novel features. The rotary shuttle takes the thread directly from the needle, with consequent simplification of the machine. The looper mechanism is used in conjunction with a thread hook, and the thread is put on the needle so that ample allowance is made while drawing up through the work to prevent any chafing of the thread in the barb. The needle guide has a positive action, and holds the needle very firmly at all times. The thread-measuring device is very simple, consisting of two rollers, across which the thread passes, and a third roller connected with the moving parts of the machine, which is adapted to move between the former and pull off a certain amount of thread, this amount being regulated by the position of the two first-mentioned rollers which are connected to the presser foot. The stitch-lengthening arrangement is always fitted to the machines for welted work, and a Scotch edge attachment is also put on. The machine will do the lightest ladies' to the heaviest work of three-quarter-inch substance.

The "Slugger," illustrated on Plate 98, is a simple machine in its action, and which may be used for slugging the edge of top pieces, or for quilting the bottoms of the soles, increasing the wearing power; it cuts the lightest to the heaviest wire with a shearing cut, leaving a smooth surface and rendering filling unnecessary after the boot is finished. The back of the work is also perfectly smooth, and the wire may be changed in a few minutes. The slugs being driven into the solid leather, there is no risk of them jarring or dropping out.

To face Page 188. Plate 94.



Loose Rivetting and Studding Machine.



Heel Builder.

Heel Building and Loose Rivetting and Studding Machinery, by

Messrs. GIMSON & Co., LEICESTER.

The "Screwer" on Page 98, possesses a novel wire-feeding mechanism, in which the grippers hold the wire with a grip proportionate to the amount of power required to insert it. The mechanism of the sliding parts for feeding the wire, consists of a strong frame instead of the usual small yoke. The cams are arranged across the machine with a central worm wheel of large diameter, which makes a very satisfactory drive, and is found to work very smoothly. The wire-inserting spindle runs at 4,000 revolutions a minute, and arrangements are made so that lubrication of the bearings prevents any heating, with common attention to oiling.

The "Stitch Separator" works on a new principle. A patented gauge is applied to the edge of the shoe, and the number of stitches per inch read off, the feed of the machine is set to this and the work put under the indenting tool. When starting the machine, the stitches will all be pricked up to one standard length. Where a slight variation occurs, which is common in practice, a knee lever is provided which allows of the slight lengthening or shortening of the stitch as the work is fed along, and these inequalities can be easily followed by this means. The result is that the operator does not depend upon the stitches being raised above the general surface of the welt.

The "Standard Rotary System," as organised in a modern shoe factory, is shewn on Plate 97. The order in which the machines are placed represent the order of the processes. The work would be taken into the department through the opening A, being inspected and allotted by the foreman, whose office is shewn on the left-hand side of the plan. It would then be assembled on the bench, on the left-hand side of the room, and would be passed on to the insole tacker-on, and to the operator who skives toes and puts in stiffenings.

From these it goes to the pullers-over, and then across to the lasting and bracing machines, and is then passed round to the welt sewer. In this case the sewing department is divided from the lasting department by a screen, the work would therefore be placed upon racks, which would be wheeled from the lasters to the sewers ; taken off by him and replaced ; it would then be passed up to the seam trimmers, and so on to the welt beaters.

This question of seam trimming and welt beating has been dealt with elsewhere ; but it may be mentioned here that where a welt is required to be of the very highest order, it is an advantage to bone it up by hand after taking it off the beating machine.

The work is now passed across to the bottom-filling bench, where the bottoms are filled up, the sole prepared and cemented, and the bottom of the boot generally made ready for the "Sole Layer." The boot is now passed across the bench to the "Sole Laying Machine," and then on to the "Rounder" and "Channeller." After the channel is opened, the next operation is stitching.

The cutting down of the front of the heel, termed breasting, may be done by machine upon one of two principles ; the heel may be cut down before being attached, or cut after attachment. Both of these methods have advantages and defects ; but both are capable of good work, if care is taken in the operation. The principal defect in breasting heels before being attached, is the liability for the knife to throw up a burr or rough edge along the lower edge of the cut. If this occurs, the finisher has to take it out by hand ; but it should not occur if the knives are kept sharp, and care is taken in the operation. If care is taken, this is an excellent method of breasting the heel, as the danger of cutting the sole by the downward thrust of the knife is quite avoided.

Heels breasted after being attached are cut down by a knife, of which the cutting edge should be the same shape as the curve of the sole across the front of the heel. If care is taken to preserve this shape, the cut may be regulated to exactly cut through the heel without damaging the sole. If it is not properly regulated, it either does not reach the bottom of the heel or it cuts into the sole. These defects have been mentioned with the object of drawing attention to the common cause of trouble in the finishing room, owing to carelessness in previous operations.

"Power Heel Breasting Machine,"—Plate 91. This machine is a decided innovation in the breasting of heels, being a power machine, and very rapid and accurate in its work. It can be quickly adjusted to breast any size shoe, from the smallest size children's, to the largest size men's, of all heights, either straight or concave. It breasts the heel after attachment. This machine can be adjusted to breast any size shoe and any height of heel, cutting the breast straight or concave. It has also adjustments which perfectly regulate the depth of the cut, so that cutting into the sole is scarcely possible unless through carelessness. The knife is very simple in construction, very easily changed, and easily filled up. As can be seen by inspection of the Plate, the boot is placed upon a jack, swung into place, where it is held by adjustments, and the knife plunger brought into operation by the movement of a treadle.

In operation, the shoe is held firmly in position by a levelling plate, fitted with adjustments, which make it possible to breast on any angle, either on or off the wooden last. The knife is very simple in construction, easily changed, and can be filled up readily.

There are also adjustments which regulate perfectly the depth of cut, so that the possibility of cutting into the sole is reduced to the minimum.

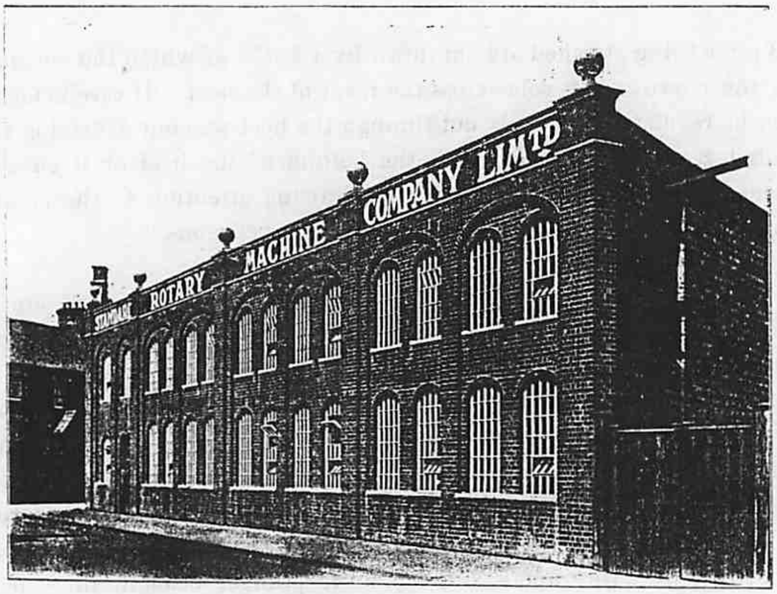
The breasting of heels before being attached is represented by the "Automatic Power Heel Breaster," illustrated upon Plate 107. This machine has a special guard for tip heels, so that the heel may be breasted without injury to the knife; the knife of this machine should be kept sharp. If ordinary care is taken in this matter, no difficulty will occur with regard to cleanness of the lower cut. The heels are built and fed in the machine by holders in front of a guard. A table moves by four movements, each one of these movements placing a heel under the breasting knife. Directly the buffer reaches the heel and holds it, the knife descends and breasts the heel. The table then takes another quarter turn, and the action is repeated. While the table is stationary, the breasted heel is fed out of the machine by an arm fixed over the table. This machine should be run at about 425 revolutions per minute; the pace should not be exceeded, and at this rate would breast 18 heels per minute.

For a mixed class trade it is advisable to keep two stitching machines, so that the different substance of work and the different threads may be provided for with the least possible trouble. From the stitchers the work would proceed to the channel closing, and then across to the levelling and heeling department, after that the leveller and the heeler.

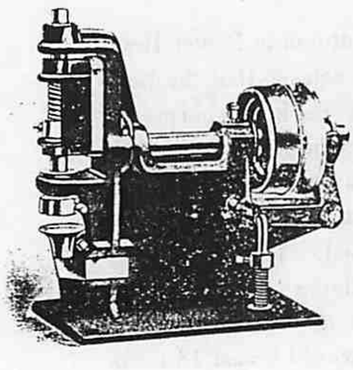
An "Edge Trimming Machine" should be used to give the first shaping to the edges. This provides a better guide for the heeler than the condition the bottom is left in when taken straight off the Levelling Machine to the Heeling Machine.

To face Page 190.

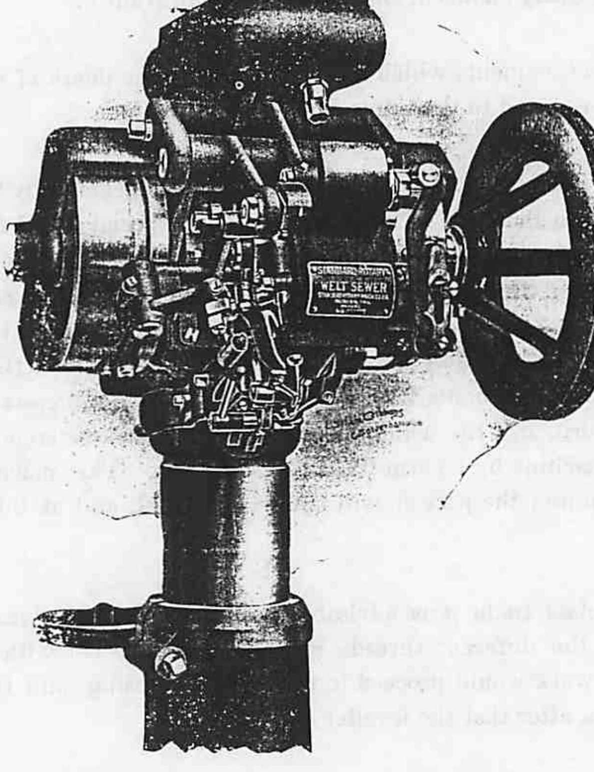
Plate 95.

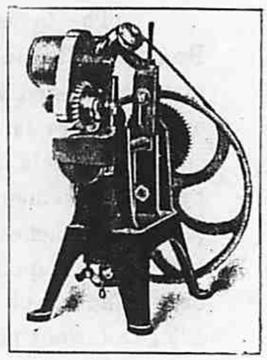


Standard Rotary Machine Works, Rushden.



Welt Beater.





Chain Welt Sewer.

Machine Systems by

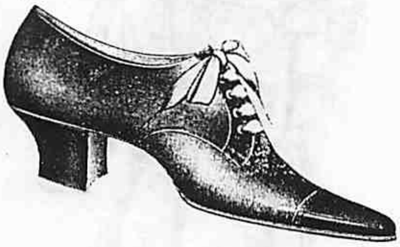
THE STANDARD ROTARY MACHINE Co.,

RUSHDEN, R.S.O.

(See Plate 96).

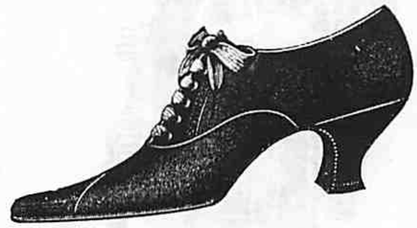
To face Page 190.

Plate 96.



4—Military.

2 & 3—Ladies' & Children's Square.



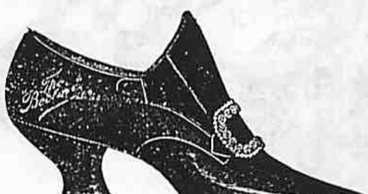
8 Stitched Louis.

5—Floated Top Piece.

7—Built Wurtenburg.

6—Swelled Seat Half Wurtenburg.

1—Men's Square.



9—Covered Heel.

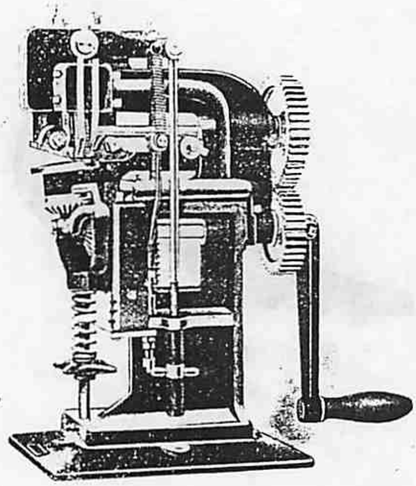
10—Wedge Heel.

Different Types of Heels.

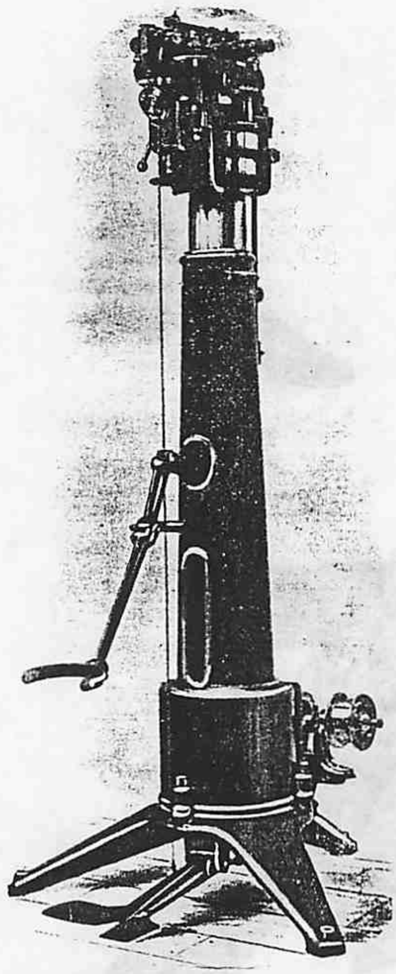
To face Page 191.

Plate 96a.

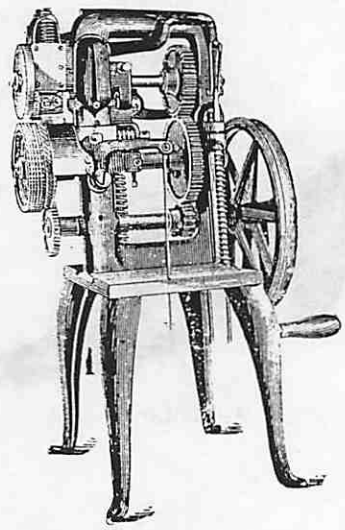
Standard Rotary



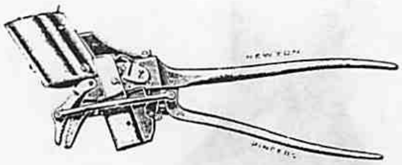
Insole Channeller.



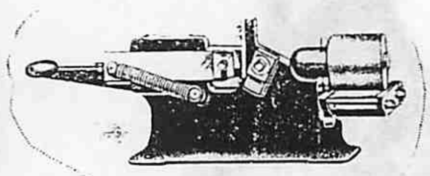
Rounder and Channeller.



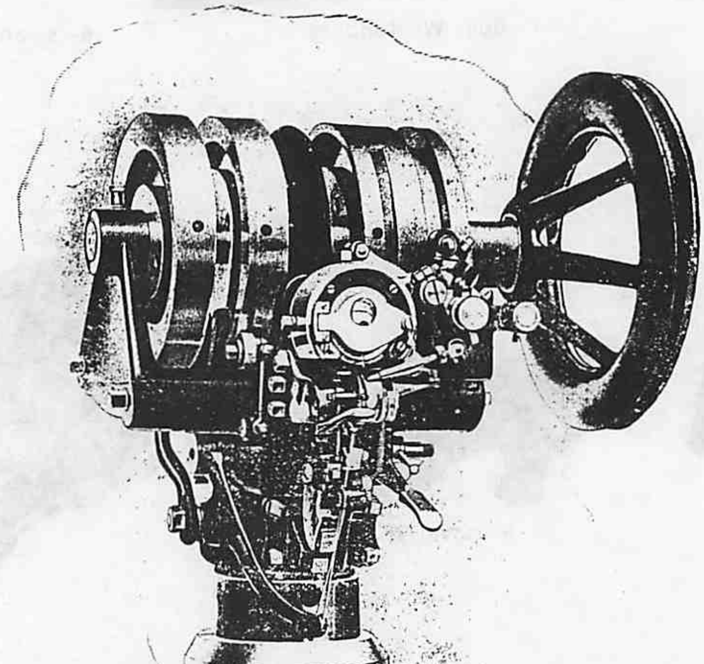
Channeller
For Stitched, Screwed, or M.S.



Pincers.



Welt Splitter, Beveller, and Groover.



Lockstitch Outsole Stitcher.

(See Plate 97).

Machine Systems by
The STANDARD ROTARY MACHINE Co.,
RUSHDEN, R.S.O.

The shoe may now be passed to the finishing department in its present condition, or the last may be slipped and returned to the assembly bench, according to the class of trade. It is certainly an advantage to allow the last to remain in the goods until the finish of all the processes, including Finishing. The goods get less knocked about; the upper shrinks into the shape of the last better, and there is no re-lasting in the finishing room. We may now consider that the bottoms being attached, the next processes will be executed in the finishing department.

Plate 91 illustrates the "Lightning Heel Attacher." The nails in this machine are driven by a plunger action, which drives them in such a manner that a short length is left for the attachment of the top piece. The machine is operated by one man, who is assisted by a boy who feeds the machine with nails. These nails are fed through a metal plate, which swings from the boy towards the plunger. The boot is placed under the machine with the heel in correct position; the plungers then descend and attach the heel. The top piece is then placed into position, and another movement attaches the top piece. It is one of the fastest and one of the most popular automatic machines in use.

The "Mayo Heeling Machine"—see Plate 73, is unquestionably the fastest machine there is; it is, as near as possible, quite automatic in its action. The attachment is by means of cut pins, which are fed down a tack race in a similar manner to the tack feed upon lasting machines. A special arrangement is made to provide against the tack being delivered in an incorrect manner. In the event of the tack getting into the race, with the point upwards, a special device clears the tack and turns it into the correct position; these tacks, besides being fed automatically, are also driven without special operation. The heel is fed by a boy, as the operator places the boot upon the jack. The machine now attaches the heel while the boy feeds the top piece; the top piece is then blinded on by another movement of the machine. The boot is then brought forward and taken from the jack, the boy in the meantime feeding the heel stuff; the machine is then ready for the next heeling operation. The capacity of this machine is practically only limited by the speed of the man operating it. A moderate estimate would be about 10,000 pairs per week.

The "Giant Standard Rotary Heeling Machine" is constructed to heel the boot on or off the last. This machine is fitted with an entirely novel top piece attacher, which is very rapid, and is so arranged that it is impossible for the top piece when attached, to be out of truth with the seat. The top piece is placed in position by the mechanism of the machine, which works with great accuracy; the operator could not attach it out of its correct location if he tried to do so.

The machine is double feeding, consequently the moment the heel is in position, the top piece is brought forward and attached as fast as the operator can press the treadle. The operator is not under the necessity of waiting for the lad feeding, under any circumstances. Capacity—550 to 600 pairs per day, under ordinary conditions.

There is no doubt but that an ideal arrangement of a department in a shoe factory would be represented by the lay out for some one class of work; but modern competition makes it very difficult for manufacturers to confine their production to one kind of boot only. Therefore, an arrangement representing only one method, would scarcely be representative of the practical factory; indeed, the one team system is already illustrated on Plate 79. The arrangement of a department designed to produce a mixed class of Welted, Turnshoe, McKay sewn, Rivetted, and Screwed work, is illustrated upon Plate 82.

This plan represents the systematic arrangement of a set of machines provided by The British United Machinery Company. It should be observed that the arrangement of the machines provide for the systematic execution of the processes in their natural order, and that where particular machines execute processes common to all classes of work, they are so placed that the work can be passed from them to any of the following processes without confusion ; but at the same time the different classes of machines executing certain work have been grouped in separate divisions.

A fault frequently found in factories, is the absence of proper provision for the movement of goods, and for the storing of lasts and other apparatus and materials that are liable to become disorderly.

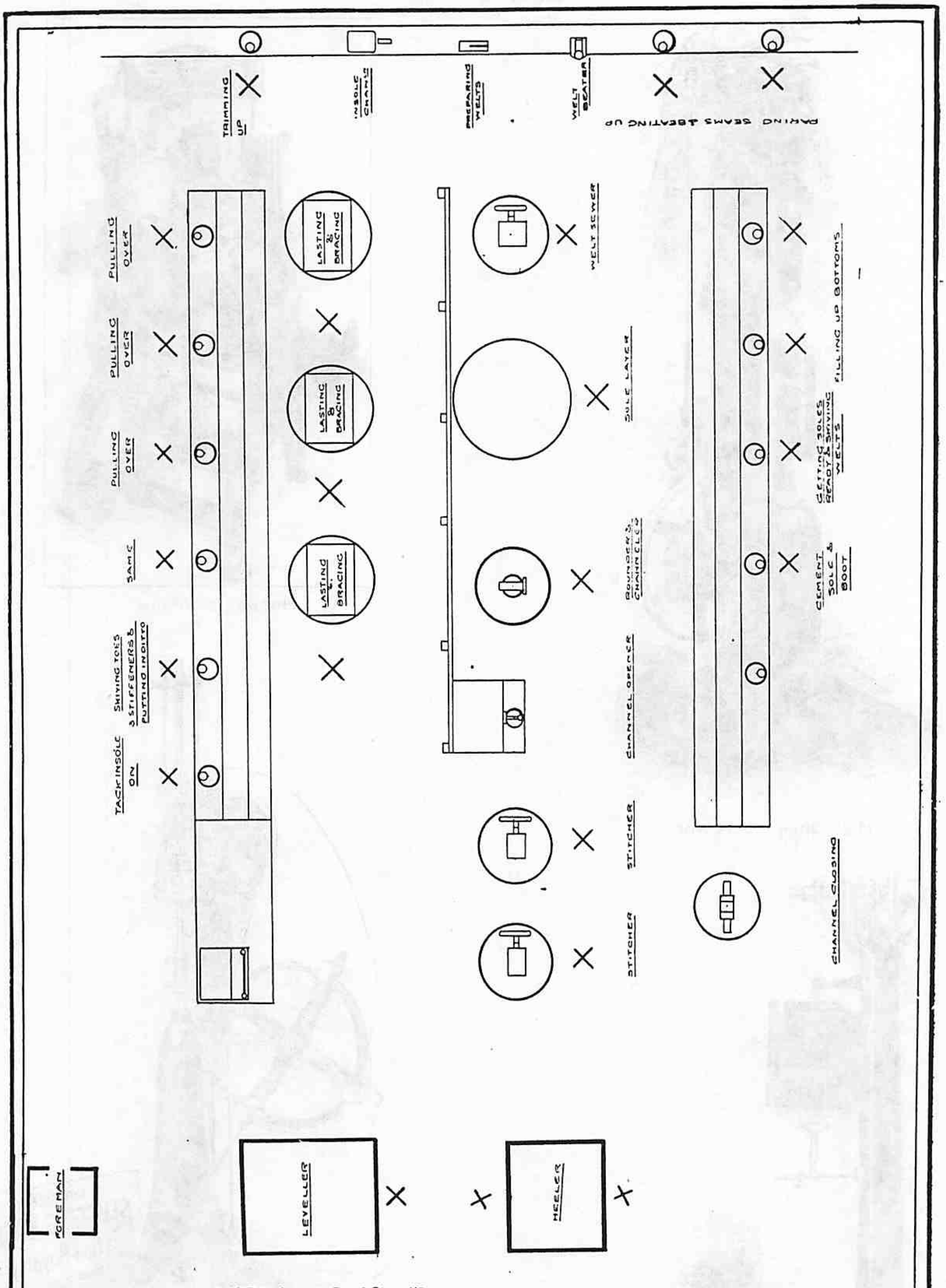
The foreman's office is placed opposite the inlet for work, with space in front of it for baskets or skips, where the work can be delivered from the other departments. By this arrangement, which would produce about 2,400 or 2,500 per week, the whole of the work would first pass to the assembly bench. Provision has been made for three assemblers, who would insert the stiffenings, place the upper over the last, and draw the lining fairly clear ; they would then pass the shoe to the pulling-over machine. The pull-over operator would keep two lasting machines running.

Mention should be made here that in a mixed class of trade these men should not work without any margin of work between them, that is, the man on the pull-over machine could not be expected to pull-over shoes and pass them straight to a welt-lasting machine and to a McKay lasting machine at exactly the correct pace that would keep both these machines running at their best pace. Is is therefore advisable that he should be a few pairs ahead of each lasting operator. The action of these machines is explained in detail under their headings.

Upon leaving the lasting machines the shoe would either go across to the Goodyear set or towards the machine-sewn division. If passed towards the machine-sewn, it would first go to the toe-cutting machine, where the loose stuff will be trimmed off, and then to the knocking-up machine, which takes the place of the tapper-up mentioned, when referring to other teams. The work then goes straight to the attachers, the tacker-on attaching the sole by the staple or the wire-grip tacker. The last is then slipped and returned to the assembly bench. The shoe would now go to the machine that would attach the sole ; this may be the Blake-sewer for sewn work, the Loose-nailer for rivetted work, the Standard screwer for screwed work, the Pegger, or any other machine that might be used for the attachment of the bottoms. Any variation in the class of work could be provided for by substituting other machines for those shewn, or by adding to their number. In the case of sewn-work or any work with channels, the next operation would be laying the channels. The work would then be passed to the levelling machine and then to the heeling department. As mentioned elsewhere, it is sometimes an advantage to trim the edges before heeling, this could be done by simply placing the trimmer at the side of the "Lightning Heeler," shewn on the plan.

The welted and turnshoe work would go straight over to the Goodyear inseam machine, and so on to the turnshoe or the welted divisions. The arrangement of the turnshoe machines are in the centre of the shop ; the shoe, after being sewn, is passed to the trimmer and on to the seam hammerer, and then across to the turning machines. After turning, the travel of the shoe would depend upon the style of the heel ; very peculiar heels would require a special set out for their attachment ; this could be made in the space vacant in the centre of the shop, and would depend upon the style of heel.

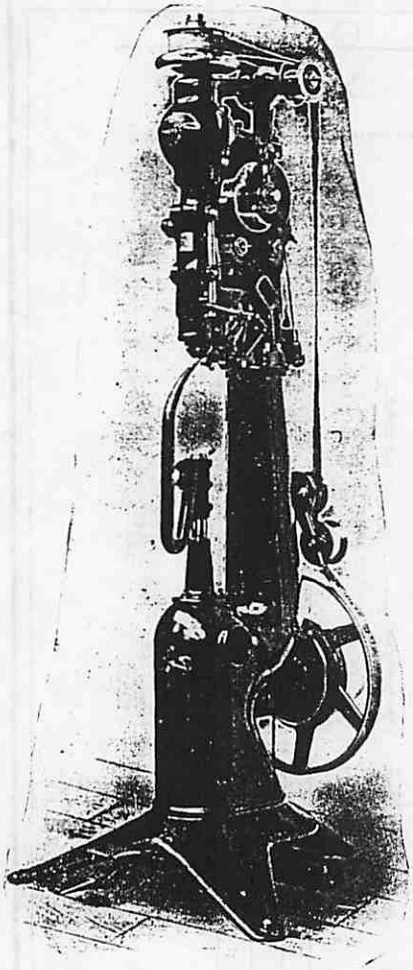
Plate 97.



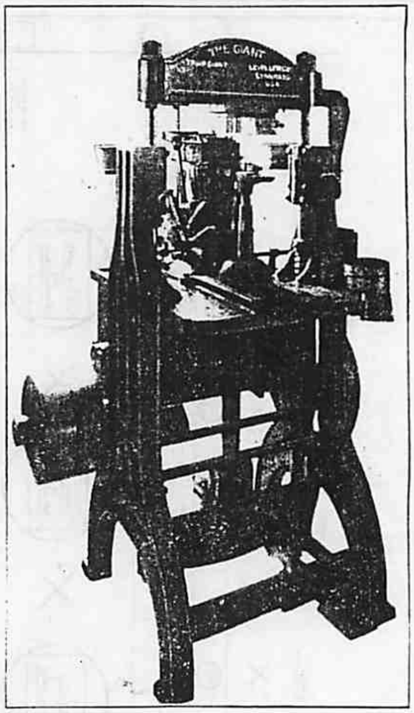
Lasting and Attaching Room—Standard Rotary System.

Plate 98.

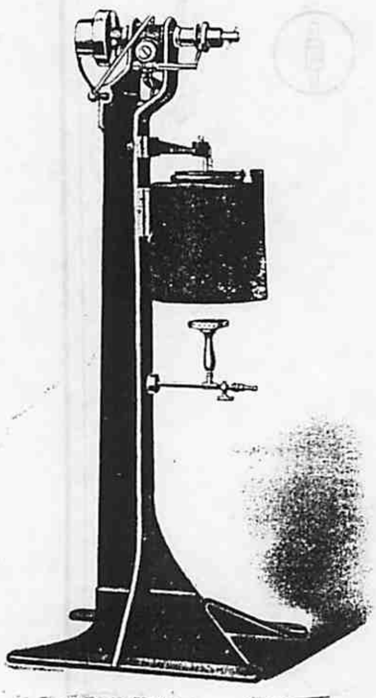
Standard Rotary



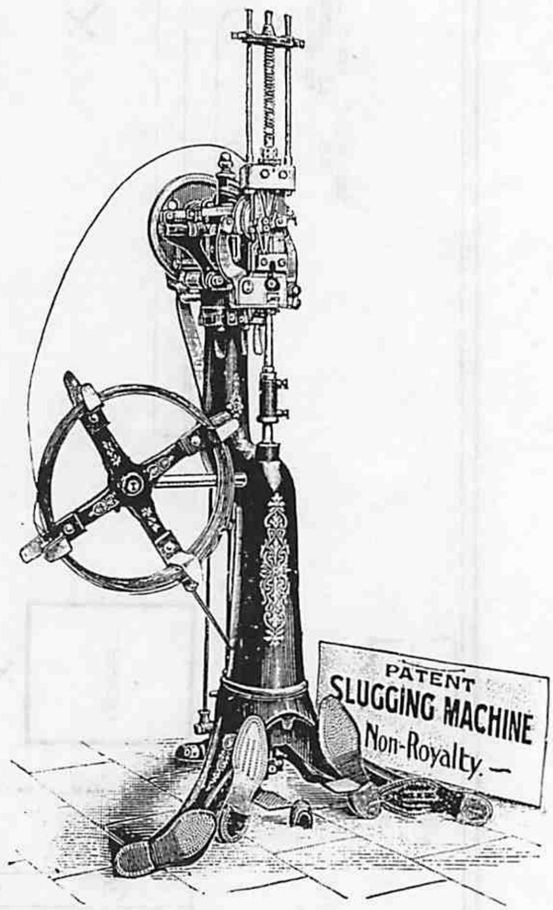
High Speed Screwer.



Heeling Machine.



Cop Winder (automatic).



Slugging and Quilting Machine. (Patent).

Machine Systems by
THE STANDARD ROTARY MACHINE CO., RUSHDEN, R.S.O

In some cases, as in wood heels, some hand work would be required; for Louis heels, the shoe would be passed back to the tacker, to have the front of the heel fastened up by a staple—See Turn-shoes and Heeling.

The welted work would go from the welting machine to the seam trimmer, and then to the welt beater, the bottom would then be cemented and then filled up.

At about this stage the greatest care should be taken that the work is kept in temper: the making of a good shoe depends very much upon the condition of the leather when the different parts are attached together. Some of these parts now require drying, others require keeping damp, the details of these processes are explained elsewhere. The drying fan and rack and water trough are shewn upon the plan.

The shoe now goes to the sole layer, and after laying, to the Goodyear Rounder and Channeller, and to the Shank Skiver.

The next operations are the stitching. The channel is opened and the shoe stitched; the following operations are closing the channels and levelling the bottoms; after which the shoe is passed across to the heeling department, where it takes its place with the work previously described, and is passed into the finishing room.

This represents the system of moving the work about. If the processes came through with absolute uniformity, there would be no necessity for supervision; but owing to the want of constancy in the nature of material, there is always a liability for little defects to occur in the work. These defects, although frequently small in themselves, are often serious obstructions to the progress of the work, and therefore an intelligent superintendent is practically indispensable in this department. This person should be a shoemaker, and should also be a mechanic; he should know precisely the practical methods by which certain results are obtainable, and he should also know the possibilities and the limitations of each machine in his department. With a man of this type at the head of the room, any trouble that happened to arise would be promptly remedied. There should be somewhere about the room a man or two capable of doing the work of the hand-craft, so that defects caused by unusual conditions of material could be remedied.

CHAPTER XII.

Finishing by Hand and Machine.

ALTHOUGH machine-finishing has practically superseded hand-work during the last few years, the ideal finish is still a perfect imitation of the highest class hand-finish. It is therefore advisable to first describe the method of finishing a boot by hand. Indeed, it forms the simplest introduction to the description of finishing by machine. It will also permit of a comparison between the tools of the hand-worker and the representation of them in the form of machines. Although much progress has been made in securing regularity of finish, finishing machines and machine methods are still mechanical reproductions of hand processes, and it is a somewhat curious fact that there appears to be a tendency among buyers of good class work to desire the points and the peculiarities of the hand-finish.

The hand-finishing operations are carried out in five distinct stages: the worker should endeavour to include in each of these all the operations required by one set of tools. Failing this systematic order, there is a tendency to increase the labour required by the number of times the tools are handled; as a rule, a tool should be used only once, and then put down for subsequent operations. The usual order is—Knifing-up; Setting into colour; Ironing-up; Marking out; Rubbing-up.

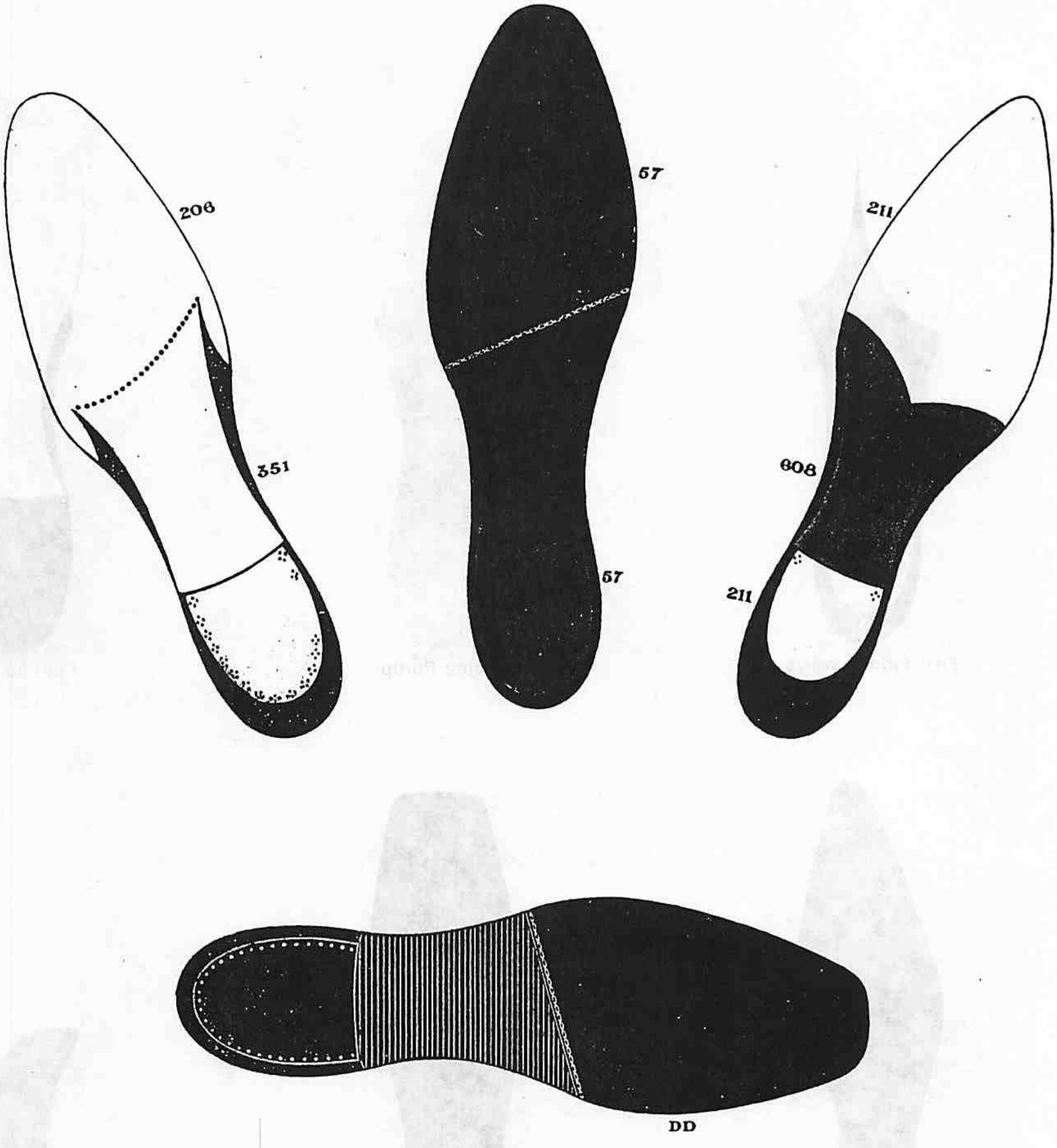
The tools used consist of knives of various shapes, set into handles that assist the operations. These are followed by irons that are of a similar shape to the knives, which burnish the ink or wax placed upon the surface to be finished. The principal tools used in hand-finishing are illustrated upon Plates 103, 104, 105, and 106.

The surfaces of the edges and bottoms are smoothed by the use of sand-paper, and coloured with inks and stains. The latter have been much improved with the introduction of machine methods; the manufacture of these having become a distinct trade, and systematized so that the repetition of a colour is absolutely assured. Specimens of these are shewn upon Plate 99, by which it will be seen that the colours are registered by the producers, so that reference to the number assures a supply of the identical shade. The hand-finisher usually made his own shades—some of them very skilfully; and as certain of these are still popular, the recipes are given for those most commonly used.

It is usual to put the sock in the boots before the lasts are put in; the last beds the sock down to the insole and insures it sticking. The next operation is to insert a last in the boot, this last should be the same shape as the last the boot was made on.

The boot is then damped down all over the bottom and along the edges, and then shaved. The shave being held as illustrated on Plate 103.

Usually, the finisher pushes the shave from him, in which case the boot is placed sideways on the knee, with the toe towards the worker; and the shave is carried from the side of the heel to the

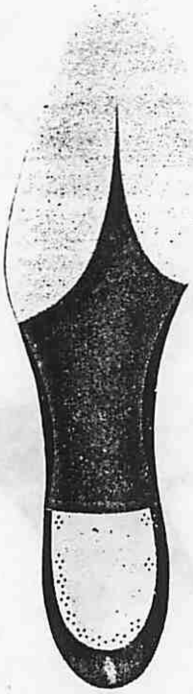


SPECIMEN OF BOTTOM . . . FINISHES. . .

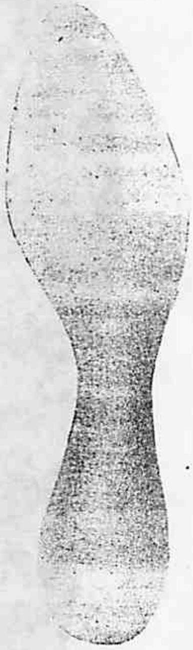
BY THE
BOSTON BLACKING COMPANY, LIMITED,
Northampton Square,
LEICESTER.

THE BOSTON BLACKING COMPANY'S "REFERENCE" NUMBER IS PLACED OPPOSITE EACH COLOR.

Plate 100.



Fish Fiddle Waist.



Dancing Pump.

Peaked Strip.

Diamond Corrugated
Bow Waist.

Black Bottom.

Wing Fiddle Waist.

Specimens of Bottom Finishes.

back. The toe is then placed between the knee, being gripped firmly, and the shaving carried round the back of the heel. The boot is now laid upon the knee with the toe from the workman, and the shaving continued to the side of the seat.

A matter upon which too much stress cannot be laid is, the keeping of shaves, buff-knives, irons, and in fact all the kit, in proper working order. When a heel or forepart is shaved with a dull shave, the leather is not cut but forced off; this forcing off of the leather will often cause it to fire, and it is difficult to get a good black polish upon fired leather.

The next operation is to cut down the rough edges along the waist, and take out the front of the heel. All rough parts to be trimmed away with a knife should now be completed. This is called knifing-up. The fore part is now shaved or rounded, the shaver used should be three numbers higher than that used for the heel; usually, a No. 6 heel-shave is used for shaving edges. In very fine work some finishers use an edge-plane or trimmer, as illustrated upon Plate 104. A special double-handed edge-plane is also shewn. In both these classes of trimmers A represents the forging handle; B is the cutter; C the movable guard; D is the face of the tool; E is the fixed guard; the width of the cutter surface is decided by the distance between E and C, which is fixed by the set screw, F.

The edges and the forepart are now scraped with an edge-scraper, which is generally made of a shape that represents different degrees of curvature, so that it may suit hollow or comparatively flat edges. The top-piece is now filed off smooth, usually in two operations; first with the rough file, and then with the smooth. The frill thrown up by the filing should be carefully taken off the edges.

The edges of the forepart and heel are then scoured, and the rough edges thrown up by rasping and scouring, taken off; a fine file being run round the sole and top-piece to take off all frills and lay them down level.

The edge of the welts are now trimmed out with the welt trimmer; this consists of a tool as shewn upon Plate 103. If a coloured welt is required, it is advisable to trim or scour off the grain. The trim of the welt should be sufficient to reduce the edge to the required substance, but it should not be excessive. It is a very bad point with some classes of work that there is far too much taken out; they appear to be bevel-edged welts.

The waist and seat are next made level, taking off the edges of the waist to suit the kind of finish required, and levelling the seat from corner to corner, so that when held up level to the eye, it represents a straight line. The grain is now buffed off, the sole and the channel smoothed down in the waist with the round side of a file. The smooth file is also run all over the grain of the waist to open out the grain. The waist is then sand-papered.

The next operation would be to prick up the stitches, if it is a stitched boot, or to fudge the welt for a machine-sewn. In the case of the stitched boot, it is advisable to first run a solution of gum arabic along the welt, work it into the stitches with the bone, and allow it to become hard. This makes the stitches solid, and fixes them after pricking up. The waist is now marked out into whatever fashion it is required—See Plates.

All the edges are now rubbed over with paraffin wax, and the edge-setting tools worked over the edges, setting them up cold into the shape they are to be finished. This is called setting up cold. Some finishers prefer to use a warm iron, but the process would be the same.

The shape of the waist should be marked from joint to joint, and along the edge, as far as the black waist is intended to reach. Slightly score along the top of this mark with a sharp knife; this will prevent the ink from striking over.

Black waists are finished in any number of different ways or shapes along the top—See Plates 99, 100, 101. The most common shape being the bow from joint to joint. These bows are sometimes marked under, that is, with the curve towards the heel, but in most cases the bow of the waist is turned the other way.

The boot is now ready for colour or inking. The quality of the polish depends to a great extent upon the ink—Some very good recipes are given at the conclusion of this Chapter. The edges and heels are now inked. The ink is put on with an ink mop or a brush, and the boots left until the ink begins to turn blue, when they are ready for ironing.

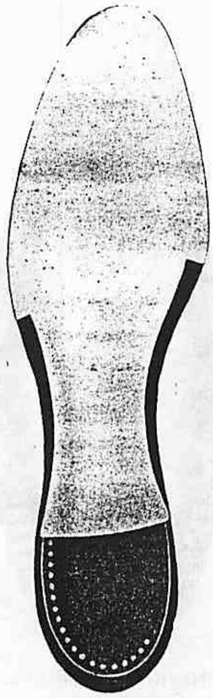
All irons are used hot; care must be taken that they are not too hot, for some leather burns very easily, and when burned, the part has to be buffed off to secure a new surface to work upon. These irons vary in substance and shape, most of them being shewn upon Plate 105.

The waist or shank of boot and top-piece of heel, are first burnished with burnisher—See Plate 106. The burnisher being rubbed up and down the waist briskly until a good polish is produced. This process is repeated on the top-piece, care being taken to remove all the ink from the studs, so that they shall shew up clean and bright. Different kinds of burnishers are used, some having one side flat and one round, others being rounded on both sides. A special heavy burnisher is used for black bottoms. The side of waist on extreme edge of sole is next ironed with a waist iron.

The front of the heel being hollow and the burnisher straight, there is a small portion of the waist just under the heel that the burnisher does not reach. This is now polished with a piece of kit called a jigger, which is so shaped that it will reach right to the corners in the front of the heel. The edge of the forepart is now ironed with the forepart iron. Damp the forepart with a little ink, then iron briskly with the iron until a good polish is produced and the edge shaped to the iron.

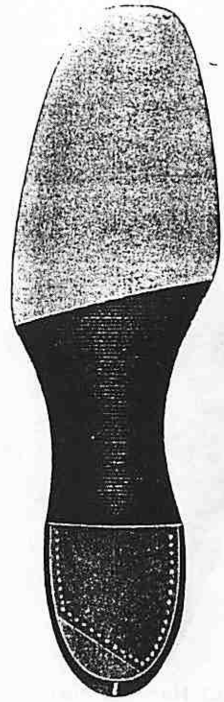
In setting the edge, the forepart is ironed; the jigger wire worked on the edge of the welt; and the crease made on the edge. The crease is the very fine line of beading that runs round the edge of the forepart next the bottom. The jigger wire is that narrow line of the fluting that shows on extreme edge of the welt, just in front of the stitched wheel print.

It may seem that the top edge of the forepart is mis-named in being called a crease, but in the forepart iron the crease is sunk into the face of the iron just in front of the lip, and this is really a crease in the iron, although the print of it on the forepart makes a bead. So it must be understood that the crease is so called because it is formed by a crease in the iron. The same remarks apply to the jigger wire. At one time when finishing kit was in a primitive state, the forepart was finished with two irons instead of one. The crease of the forepart was set with a top iron, and the other part

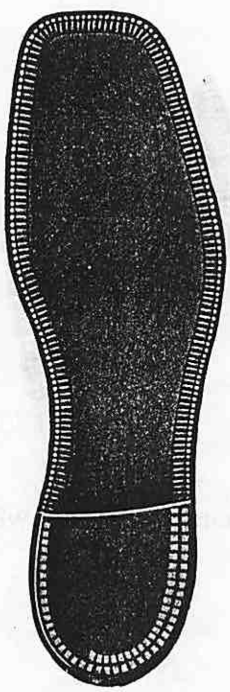


Square Strip Waist.

Running Shoe.



Corrugated Waist.



Stitched aloft.
½ Wide Welt.

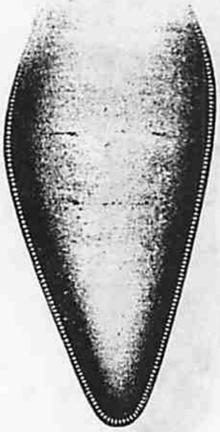
White and Black.

Stitched aloft.
Chopped Stitch.

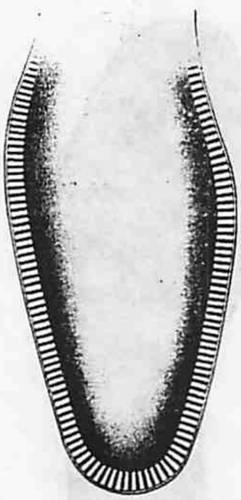
Specimens of Bottom Finishes.

To face Page 197.

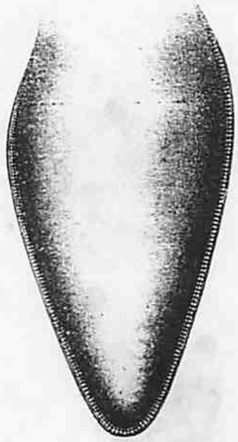
Plate 102.



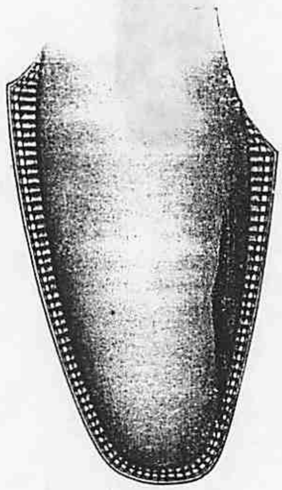
Fudged Narrow Welt.



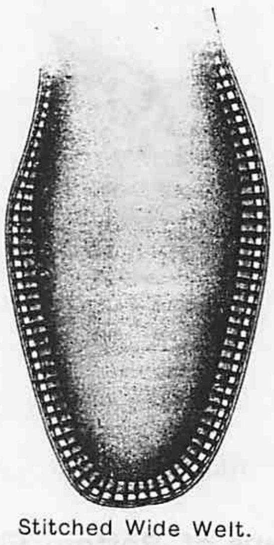
Fudged Wide Welt.



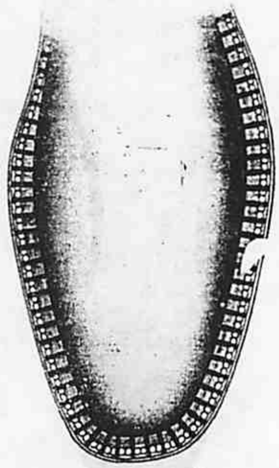
Stitched Forepart—
Close Welt.



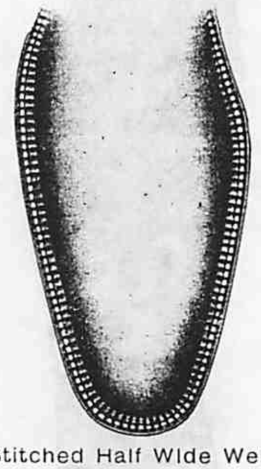
American Welt.



Stitched Wide Welt.



Stitched to Heel—
Cable Stitch.



Stitched Half Wide Welt.

Specimens of Welt Finishes.

with a jigger iron. Forepart irons are made both with and without jiggers, those without jiggers are called plain irons. Again, some irons have the jigger wire cut so that it is formed upon the bottom edge instead of on the edge of welt.

Another variety of iron has a crease cut in front of the jigger as well as under the lip, making it a double cut iron.

The welt is next stitched-wheeled in the following way. A little white heel-ball is rubbed on the welt, the stitch-wheel is run round the welt, moving it backwards and forwards until a good print of the wheel is made, taking care that the wheel is held in proper position while rounding the toe. A little heel-ball is put round the forepart after the welt is wheeled and ironed in with the forepart iron. This coat of heel-ball improves and protects the polish, and also remedies any injuries from wheeling the welt.

The burnishing of the side of the heel is the next operation, this is called "dummying"—See Plate 105. This should be first done with the edge in a dry state, then, after being damped with a little ink, keeping on with the ironing until a good hard black polish is produced. The heel, waist and top-piece are then given a coat of fake, which should be well rubbed into the leather. The boot is now ready for seat wheeling.

The seat wheel—See Plate 104—has a small backguard at one edge of the face, and a slot let into the face of the iron near to the guard; in this slot the roller of the wheel revolves upon a pin which is inserted from the side. The wheel sets the seat of the heel close to the upper, at the same time making a print of the milled edges of the roller on the seat of the heel. The boot is now ironed up.

The corners of the heels must be squared, for however carefully a heel may be dummied, the corners are sure to be forced out of shape a little. Square them with a sharp knife, then clean the front of the heel, buffing and scouring it to remove the fake or dirt. If the channel does not close up neatly, or if the boot is to be crowed on the channel in the waist, the crowing may now be done. The crow is a wheel working in the same manner as a welt wheel, the pattern being on the edge of the roller. In crowing, a copy of this pattern is printed on the leather, giving to the boots in some cases a very pretty appearance, and at the same time serving the purpose of hiding defective channels.

The bottom, or forepart of sole or bottom, is next made out. This is done as follows: first buff the grain off the sole with a buff-knife, being careful to buff it the right way of the grain—there is always one way that buffs easier than the other; the way that buffs easiest is called the right way of the grain. Anyone who has any knowledge of the structure of the hide, will know that the hair is smooth in certain directions. It is probable that the direction in which the grain can be most easily removed, is the way in which the hair lays down smoothly upon the hide. Buff the grain off with a sharp buff-knife, take care not to rough the channels up in buffing. After buffing it is smoothed with sand-paper. This is done in two operations: first with a sand-stick, which is a piece of kit made by covering two lengths of wood about 18 inches long by 2 inches wide, tapering from half-inch in thickness at one side to a feather edge with coarse sand-paper, and then with fine sand-paper round the fingers.

When scoured smooth, the bottom is ready for damping down. This is done with bottom wash, which is rubbed into the leather by means of a piece of flannel. When this has been done, the bottom must be rubbed with another piece of flannel—which must be clean and dry, to remove all superfluous wash, and then left to dry. When quite dry, polish with a soft piece of cotton rag. Sometimes French chalk is rubbed into the bottom to give it a higher polish. If this high polish is desired, the sole may be sleaked with a very smooth bone.

The shape of the top of the waist is now marked with a marking awl or dull-knife. This mark defines the waist distinctly from the forepart. The channel is next set or ironed in this manner: Rub a little brown heel-ball round the edge of the bottom, and then melt it in with either a single iron or a forepart iron. The iron should be hot, and the heel-ball should melt round the edge of the bottom. This is done to cover the channel which, if open, must be filled up with heel-ball. The boot is now ready for rubbing up. This means getting all the fake and heel-ball off, and so leaving the polish uncovered. Rubbing should be done with a soft rag. Brush the uppers and get all the dust off them. Then as a finishing touch, put a little fake on the heel and forepart, and polish it off with a soft polisher.

The varieties of finish generally consists of alterations in the bottom of the boot; bevil clumps, corks, and stitched foreparts, being the principal exception. In these cases, the difference is on the edge of the forepart, in clumps and corks, and on the welt in stitched foreparts. Welted work is practically the same to the finisher as stitched foreparts, except that the stitches are carried to the corners of the heel. In some cases the stitches are finished, in others the waists are beat close down to the upper, and the stitches covered. From this it will be seen that until the boot is ironed, the finish of a plain boot is much the same as one that is bunked and bordered, or one with a fiddle waist.

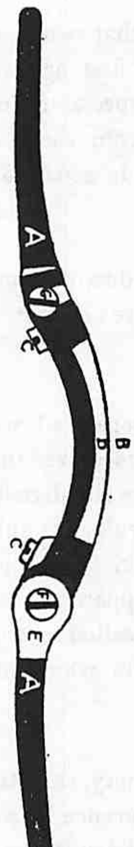
Strip Waists.—There are three kinds of these. The peak, the bow, and waist iron strip. The strip is put on after the bottom is made out. A narrow strip is marked off with the knife at the side of the waist from the front of the heel, to about the joint of the forepart. The strip thus marked off is inked with a brush and allowed to dry. When dry, it is burnished with a strip burnisher, or as it is sometimes called, a tiddler, and then a little white fake is rubbed on to it.

Strips on coloured work can be made with liquid ammatto, Bismark brown, or any colour to suit the colour of the upper. The difference between a bow and peak strips is in the termination of the strip at joint. The peak strip, as its name implies, is carried to a point at top of strip, while the bow strip is rounded off at joint. The waist iron strip reaches just about to the channel in side of waist, and is so called because it is made about the width of the lip of the ordinary waist iron.

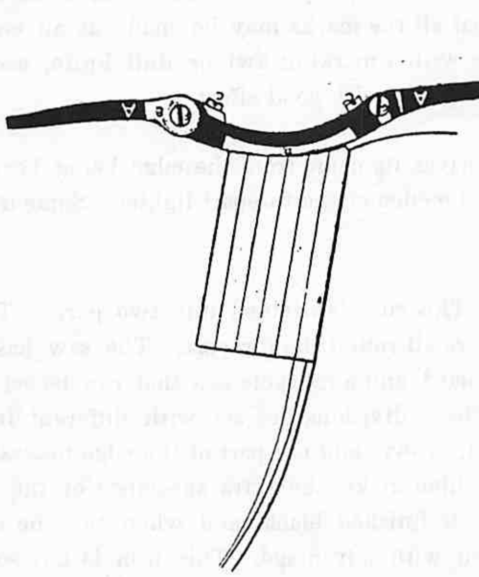
Fiddle Waists.—See Plates 99, 100, 101. The waist of a boot is referred to by this term when the centre of the waist is finished a different colour to the side and forepart. The most common kind of "fiddle" is the one with a black strip and a brown centre, while others have a brown strip and black centre; the latter are called "black fiddles," and are seen principally on pegged and rivetted work. In most cases "fiddle waists" have a black strip at the side of waist, the centre of waist being finished yellow or brown.

Corrugated Waists.—See Plates 100 and 101. This is the name given to waists that have a number of marks running close to each other, across the waist of the boot from side to side. The marks

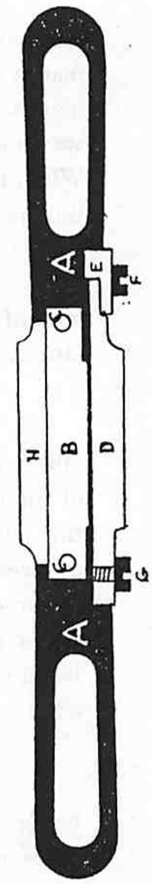
Plate 103.



Heel Shave—Face.

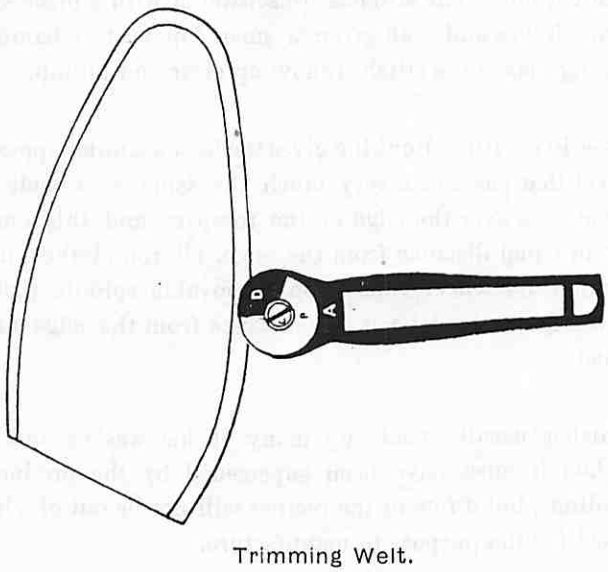


Shaving Heel.

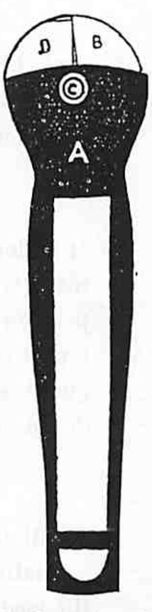


Heel Shave—Top.

Welt Plough—Back.



Trimming Welt.



Welt Plough—Face.

Hand-Finishing Kit.

are made with a corrugating iron or marking awl. The corrugating iron is made so that two or three marks can be made at the same time. An iron is run across the waist, giving the first or guiding marks, the outside tooth of the iron is then placed in the outside mark of the first impression, in this way a guide is provided, so that all the marks may be made at an equal distance from each other. When the corrugating is done with a marking awl or dull knife, each mark is made separate and independent of the others, but rarely with good effect.

Bevel Edge.—This derives its name from the edge being bevelled or sloped down from the welt of the sole, thus making the edge of the forepart lighter. Some of these bevels are brought down almost to a feather edge.

Bevel Edge Clumps.—This edge is divided into two parts. The parts are separated with a clump saw, which saws a groove all round the forepart. The saw has a lip which goes over the top of the forepart that acts as a guard, and a movable saw that can be set so that it makes the division in the edge of the forepart. These divisions are set with different irons and, as a rule, are finished different colours ; the top part, brown, and the part of the edge nearest the welt, black. The top part of the edge is shaved under, which makes the extra substance of the forepart less apparent. Sometimes the whole of the edge is finished black, and when this the case, the iron called a double-bevel slump iron, can be used with advantage. This iron is cut so that it sets the whole of the edge at once.

Stitched Foreparts.—See Plate 102. To the finisher, these are in great variety, the stitches being of various colours—white, yellow, black, and sometimes red. Besides the difference in colour, there are many different ways in which they are stitched, some are only stitched round the forepart from joint to joint, others are stitched from heel to heel, from one corner of the heel to the other. These are pricked up with a stitch pricker, which is a piece of kit like an awl, and which sets each stitch up bold.

Stitched Aloft.—See Plate 101. In this case the stitches are made right through the sole, so that they lie upon the bottom. The stitches are separated with a piece of kit called a chopper, which is placed between two stitches and then given a smart tap with a hammer, this is repeated all round the boot. The chopping makes the stitches show up clear and plump.

Bunking.—See Plate 101. Bunking gives the boot a similar appearance to a stitched-aloft boot. It is done with a wheel that has a face very much the same as a welt wheel. The Bunk wheel is fitted with a guard that goes over the edge of the forepart, and this enables the finisher to make a print of the wheel at an equal distance from the edge, all round the edge of the bottom. The best bunks are those in which the wheel runs upon a movable spindle that can be pushed out from the guard, so that the bunking can be done at any distance from the edge of the sole, and if necessary, a double row can be made.

The hand-finisher usually made up many of his washes and colours, some of these gave excellent results, although most have been superseded by the products of the trade who make a speciality of these findings, but a few of the recipes will not be out of place, for some of them form the basis of colour used for the purpose in manufacture.

The foregoing is briefly the operation of finishing by hand ; machine finishing consists of the substitution of mechanical motion for the manual action of the hand worker. In most cases the machines copy the action of the hand process very closely, indeed in some cases produce a better result.

Although the common object of finishing the edges and bottoms of footwear is to smooth and colour the materials used for the soles and heels, and the processes adopted in the machine finishing department are very similar in all classes of finish, there are considerable variations made in the division of labour, and, in some measure, the order of the processes. Generally, where a very high finish is required, the embellishments are put upon the bottom as a final process ; where these are very intricate and delicate, by hand. Upon low class work, the processes are usually arranged in the order of convenience, any slight injury to an embellishment being of less consequence than lowness of cost of the entire process.

Consequently, considerable variation in the method and cost is possible, and must be made with regard to the peculiar circumstances of each factory. In this matter the foreman of the department must be held responsible. It is not a good policy to restrict the individuality and responsibility of foremen by set rules which cannot be applicable to all circumstances.

The methods described here will, therefore, be those found to be in most general use, and the most reliable for ordinary circumstances. Intelligent modifications are expected to be made by those interested.

To prevent confusion, it may be mentioned that there are several modifications that are in common use, and which it is advisable to deal with before actually describing the finishing operations.

Some foremen prefer trimming the edges before the heels are attached. The object of this is to provide for the difficulty of cleaning out the corners of the heel when the edges are trimmed after heeling. Where this method is adopted, the edges are usually trimmed twice ; once, dry, before heeling ; and once, damp, after heeling.

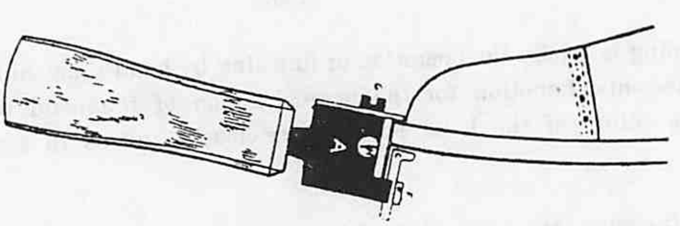
A difficulty sometimes occurs in obtaining a clean joint between the bottom of the heel in front and the sole. This is met by scouring the shank before heeling, and by that means obviating the need to scour at the joint between heel and sole after. This matter is closely connected with the method of breasting. If the heel is cut down before being attached there is some danger of a frill being formed ; this should be taken off before the heel is attached.

There is some difference in the method of dividing the labour in the finishing processes. In America, the edge-makers are generally considered as a branch distinct from the edge and bottom finishers. In England, all the processes are referred to as finishing. But the order of the processes does not vary so much between the two countries as between different shops in either, and, therefore, a generel method can be described, leaving variations to be decided by individual requirement.

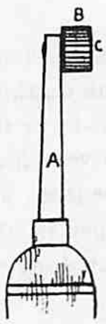
Seeing that the operation of finishing the bottom of a boot or shoe entails the use of many processes, and, consequently, a great deal of handling, the insertion of a last is indispensable to

To face Page 200.

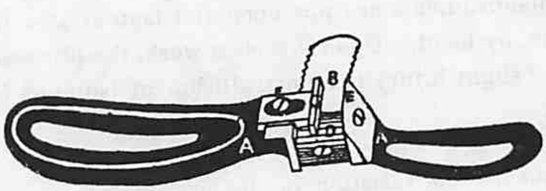
Plate 104.



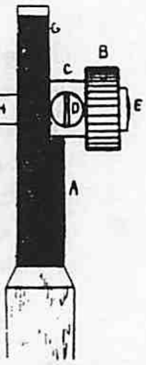
Planing Edge.



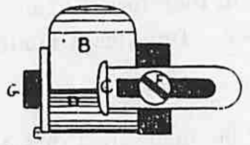
Fudge Wheel.



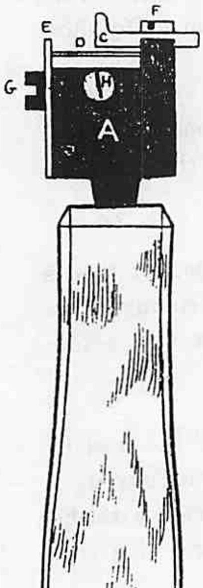
Special Trimmer.



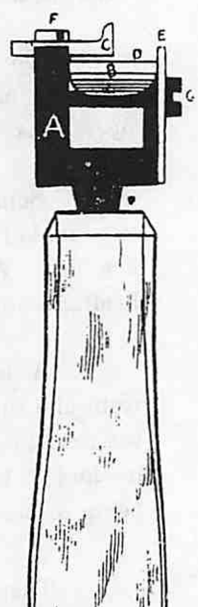
Bunk Wheel.



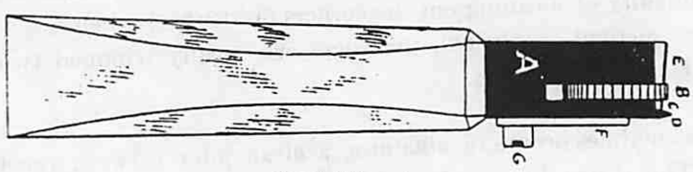
Trimmer, Top View.



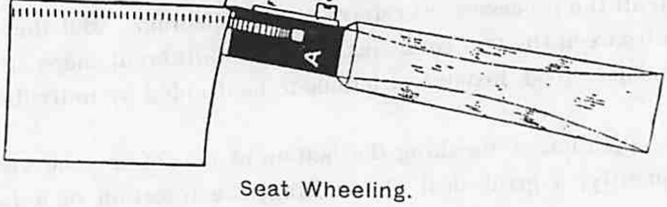
Edge Trimmer Face.



Edge Trimmer, Back.



Seat Wheel.



Seat Wheeling.

Hand Finishing Kit.

getting the work through without undue putting out of shape. It is preferable that the last which is used in the lasting of the shoe shall remain in it during all the subsequent processes through the factory. This is naturally accomplished in welted work, and is one of the reasons why shoes made upon that principle usually have a better shape, and keep it, than those which have the last withdrawn directly after lasting. In any case, the last inserted should be of the precise shape that the shoe was made upon. This process is a preliminary one to the process of finishing—(see Last Making)—but is usually performed in the finishing room.

Some classes of work have a great many finishing touches put on them by hand, others are left much as they come off the machine ; but, as a rule, the fronts require cleaning, and the studs brightening up ; the waist requires marking, and the channels set up all round. Some people prefer to have the top-lifts and the edges of the heels set up with a crease, and a large number of other little elaborations. This entails a considerable amount of hand-work, and increases the cost.

From these remarks it will be seen that the difference in the cost of finishing depends upon the amount of labour put in the shoe, and the amount of detail present or absent. If the work is being sent through very cheaply nearly all the cost of the hand bench work will be left out.

The power is transmitted from the engine by means of belts running on pulley wheels attached to shafting. The main shaft usually runs close to the ceiling, as near as possible over the top of the machine. Each machine has a counter shaft, with a pulley-wheel suitable to the pace required. The power is transmitted from the main shaft to the counter shaft under the machine by means of belts. It is very important that the main shaft should run at a given speed, and that the indicator of the engine should be very sensitive, because it is important that machines should run at their best pace ; finishing machines only doing their best work at some definite pace. This is an important part in shops that have a large plant which is at times thrown out of work. If the governor of the engine is not good it will make a greater pace when there are less machines at work than when they are all employed. Again, when the whole of the machines are started, the engine may go slow, which is a very bad thing for the machines and for the work. Belts are also an important matter. If they are are not properly arranged much power may be lost in transmission. They must be just tight enough to bite on the pulleys, getting the full benefit of the power. Sometimes they get loose and slip, in which case a little powdered resin is useful. If the belt gets loose through stretching, it should be tightened up by lacing. These laces should be of the very best quality ; good belts and bad laces are bad business.

The plan of the Machine Finishing Room illustrated on Plate 110 represents the usual arrangement for the production of about 3,000 pairs per week on men's good to medium-class work. This arrangement provides for a considerable amount of hand work, which in a lower class trade might be dispensed with ; but it has been found that for high-class finishes a certain amount of hand work is an advantage. The order of the machines would be as shown in any case ; but in this plan, one of the edge trimmers has been placed in the heeling department, to allow of the edges having the first trimming before heeling. If it was preferred that all the trimming should be done in the finishing department, that is that if the boot was heeled first and trimmed after, three edge trimmers instead of two would be required. The arrangement is intended to provide for the work done in the department being carried continuously round in one direction, so that it passes from each operative in the order of the processes. The position of each workman is shown by a cross, the oblongs represent work

racks. The work is supposed to enter at the door A, and to go straight to the lasting bench for the insertion of the last, if it is not already in the shoe. Opposite the lasting bench is the foreman's desk, convenient to both the entrance and the exit. After being lasted, the work is passed to the heel parer, on to the trimmers, and so on round the department. The actual processes would depend very much on the class of work and the finish required. The bench marked hand process at the back of the trimmers is about two-and-a-half feet wide. This would permit of a rack being pushed up to it and the work taken from the rack, if any special process was required. If no special process is needed, the racks would go straight on round the department. Two distinct sets of pads and brushes are provided for the purpose of keeping coloured work distinct from black. As a general principle, there should be sufficient work in the department for a clear day's work ; that is to say, there should be sufficient in the department each morning to last the operators throughout the whole of the day. The work should also be arranged to move continuously round the department, most of the trouble in the machine department being caused by a block of work at some one process. Apart from this, an explanation of the machines will describe the processes.

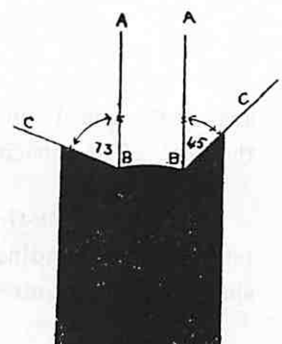
The first operations consist of shaping the edges ; this is the basis of the finish, and it may be stated, at once, that this is the point at which the beauty and durability of the edge is decided. It is useless to expect a good shape, or a solid edge or burnish, to be produced upon edges that are not correctly shaped and hardened.

Heel Parer.—These perform their action by a rotary motion. The knives are fixed into a head mounted on a shaft. The shaft carries a pulley, which has a belt which, running from the driving pulley of this machine, produces the motion. The heads are constructed to carry a number of cutters. The general principle being that the smaller the number of cutters, the higher the speed of the machine. The latest machine has two cutters. The knife is guarded on both sides. The guard to the right of the operator, as he faces the machine, is the top-piece guard, and the one on the left is the seat guard. Both guards are adjustable so that the top-piece guard can be set wide or fine, and it can also be set away from the knives, this allows of tipped and partly tipped work to be pared without injury to knives. The seat-guard or bell can be adjusted to allow of the heel being pared close or wide, and these alterations can be made while the machine is in motion. The bell-guard is made to swing back, adjusting itself to differing heights of heel, and is taken off altogether for knives to be sharpened. These knives are sharpened on a solid emery wheel ; some kinds are sharpened to a razor edge, but others have the edge turned over on the top side. The dust is carried off by means of a fan, which creates an in-draught from the machine. On most heel-parers there is a separate randing knife for the purpose of levelling the seat of the heel. These randers are circular cutters, having four or more knives cut out of one piece of steel. The latest of these machines has the rander on the side of the trimmer, so that the paring and randing may be done at one operation.

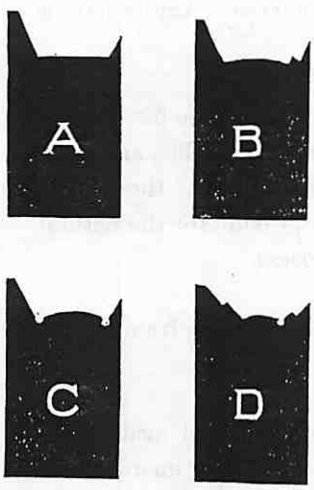
"The McKay Heel Parer"—Plate 106—which is probably one of the finest machines for men's work, consists of two blades mounted on a block, which run on a shaft driven from counter-shafts, running at about 1,200 revolutions a minute. It is fitted with a loose randing or seat knife, and an adjustable bell-guard, which automatically adjusts itself to variation in the height of heel. There is a pin and block motion between the rander and the cutter, and a racket adjustment on the body of the machine, which regulates the loose guard in relation to the knife.

The operator presses the top-piece against the loose guard, and commencing on one side of the heel, with the toe in one hand and the back of the boot in the other, simply turns the heel round

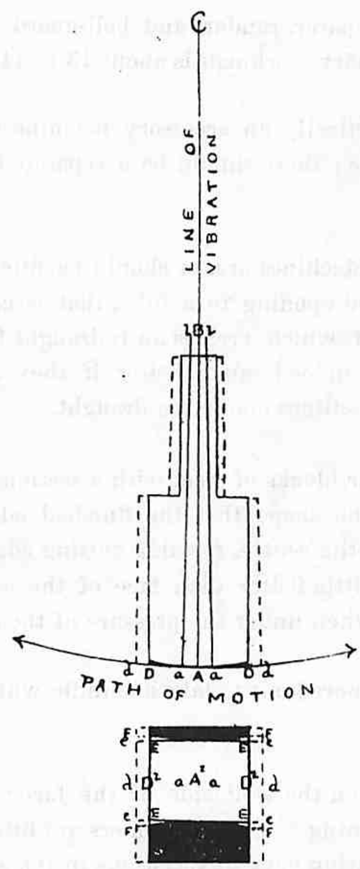
Points in Cutters and Setters.



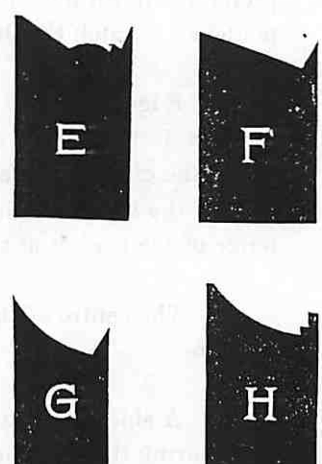
Angles of Faces in Cutters and Setters.



Sections of Cutters and Setters.

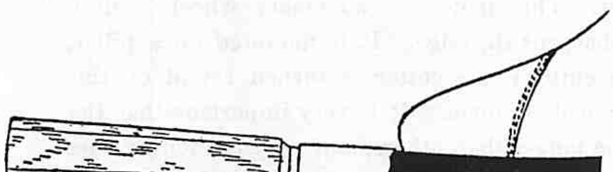


Principle of Machine Setter.

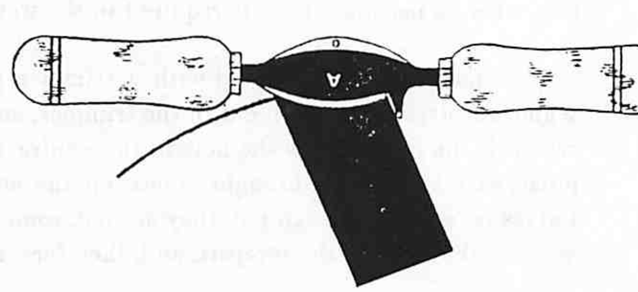


Sections of Cutters and Setters.

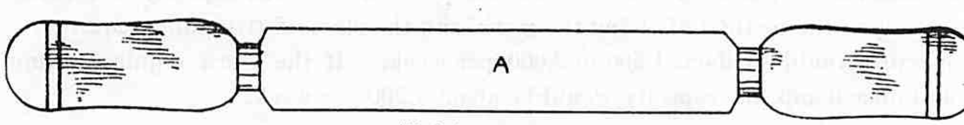
Machine Edge Shaping.



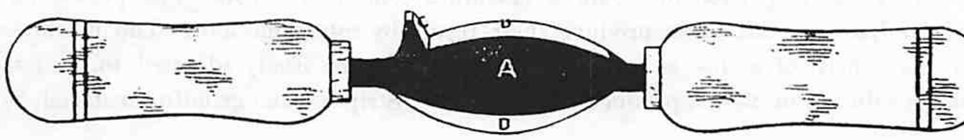
Setting Edge.



Dummying Heel.



Waist Burnisher.



Heel Dummy.

Hand Finishing Kit.

against the guard and cutter. The parer, rander, and bell-guard, make an accurate trimming round the heel. The capacity of an ordinary workman is about 13 to 14 hundred pairs per day.

The Knife-Grinder is practically an accessory machine to the heel-parer, and is fitted with templates for grinding true to shape ; there should be a separate template for each knife, according to shapes of heel required.

All Cutting and Grinding Machines are, or should be, fitted with an apparatus for removing the dust. This consists of a bell-shaped opening to a tube, that is connected with a main tube, which is fitted with a fan, the revolution of which creates an indraught from the machines. These tubes are preferable if without sharp angles, indeed much better if they are made in curves. Angles have a tendency to catch the dust and sometimes choke the draught.

Edge Trimmers are circular blocks of steel with a sectional shape representing the face of the forepart iron or edge setter, or the shape that the finished edge is required to be. Cuts are made round the circular surface towards the centre, forming cutting edges. The actual shape of the cutting edge of the trimmers should be a little flatter than face of the edge setter, to provide for the natural bulge of the leather at the edges, when under the pressure of the setting-up process.

The centre of the block is bored out to take a spindle which is mounted upon the frame of the machine.

A shield or guard is fitted on the welt side of the face ; the edge being placed against the welt during the operation of trimming. Some trimmers are fitted with a special spring guard which accommodates the width of the cutting edge to variations in the substance of the stock.

Some machines are fitted with a small cutter with loose knives to trim the sides of the waists; but most operators prefer to trim the waist with the forepart cutter. However, there is no doubt but that where a peculiar shape is required in the waist, special waist cutters should be used.

Each machine is fitted with a trimmer grinder. This grinder is an emery wheel or disc, which revolves inside each cut in the trimmer, and so sharpens the edge. It is mounted on a pillar, which is the same size as the hole in the centre of the cutter ; the cutter is turned round on this pillar, each knife being brought to bear on the emery wheel in turn. It is very important that the knives be sharpened even ; if they are not, some will be longer than others, and only the longer ones will cut the edge of the forepart, and, therefore, much of the cutting power will thus be lost.

The machine runs at about 1,200 revolutions per minute. The capacity, as regards number of pairs, depends upon the method of doing the work, and the class of trimming required. Trimming once, the operator would do about 1,500 to 2,000 per week. If the work required trimming twice, once dry, and once damp, the capacity would be about 1,200 per week.

Scouring, Sandpapering, and Buffing Machines consist of apparatus for producing motion in surfaces of sandpaper. All these produce their result by rotary motion. The machines used for scouring heels consist of a disc so constructed that it can be easily adjusted to, and taken off, a spindle, the revolution of which produces the motion. Strips of the grinding material, as sandpaper

or emery cloth, are made to fit these discs, and are attached by several different methods : by the use of a split disc, which clutches the material between the split edges ; by rubber band, and by spring attachments. The section of heel scourers should represent the shape of the heel required, and, usually, there should be three discs, fitted with paper of three degrees of coarseness. Usually, sandpaper is used for the rough scouring, No. 90 emery for the smooth, and No. 120 for polishing.

In addition to these, it is common for the heels to be hardened by friction against a marble or other stone disc, shaped as the heel scourer. This produces a surface that, after inking, will produce a good finish by the use of the brush, or the rotary burnisher. The machine should be fitted with a brush by which the operator removes the dust, leaving the work ready for the next operation.

Bottom Buffing, or Sandpapering Machines, may be divided into three types. The sole, which is very similar in construction to heel scourers, the band, and the Naumkeg. The sole consists of a split cylinder, which is fastened at the split portion and to centre spindle by screw plates. The paper is attached to the cylinder by spikes fitting into apertures upon the split portion. The opening of the cylinder permits of the paper being passed round and pressed over the spikes ; the action of closing the cylinder fastens the paper.

The band consists of an endless band of sandpaper, about a yard in circumference, which is obtained between two rollers, or cylinders. These rollers are so arranged that the distance between them may be decreased, permitting of the band being passed over them ; upon the rollers taking their original position the band is tightened. The advantage of this method is that the greater length of the scouring material prevents changing very often, and assists in keeping the scouring surface cool. These machines are constructed with two band carriers, allowing of the use of coarse and fine paper upon one machine. The motion of these machines is generally simply rotary, but some are designed to make a side motion as well, producing, nearly, the action of the hand-finisher when scouring the bottom by hand.

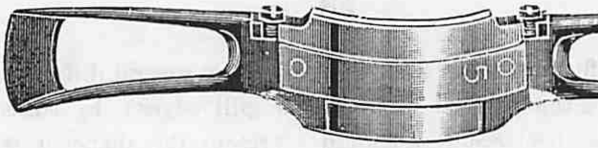
The Naumkeg consists of a perpendicular spindle, which rotates a holder having a circular horizontal face. The scouring material, or cover, is either pleated or supported by a linen back, and shaped to take a felt pad under the scouring surface. This cover, when fitted with the pad, is attached to the Naumkeg holder. This is made in two parts ; one ending in the flat circular disc, and which is inserted under the felt pad, and the other in an arrangement for holding the padded cover. This apparatus, although sometimes used for scouring bottoms on shanks, is commonly attached to roll or band scouring machines, for the purpose of reaching those parts which could not be easily scoured by these machines.

Other Scouring Machines consist of devices for cleaning or buffing certain parts. Border buffers are constructed to scour away a strip or border round the edge of the bottom of the sole. This produces a distinct edge, which can be blacked and finished. The scouring material consists of a band which travels in relation to a movable guard, this guard being fixed according to the width of border required. The edge of the sole is pressed towards the guard with the bottom towards the sandpaper roll, and the bottom moved round as the border is scoured away. This scouring cleans the paint " bottom wash," " slosh," or finish away, and permits of the border being inked.

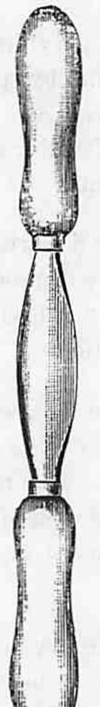
The separation of each stitch upon a welt, by a depression, is termed stitch separating, or pricking-up. The indenting of a pattern upon the flesh side of a sole, or upon the welt, or rand side of a top or middle sole, is termed fudging.

To face Page 205.

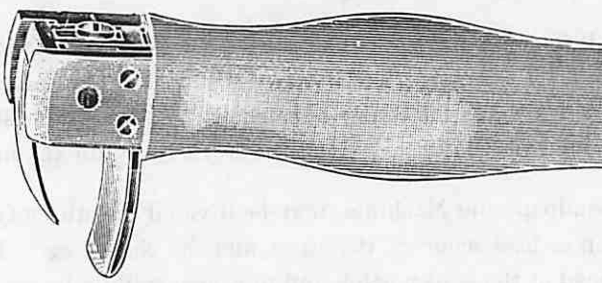
Plate 106.



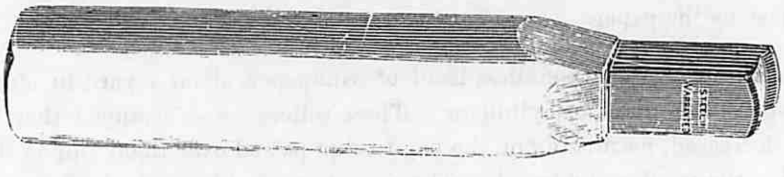
Heel Shave.



Waist Burnisher.

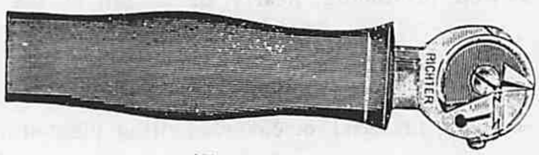


Edge Trimmer.

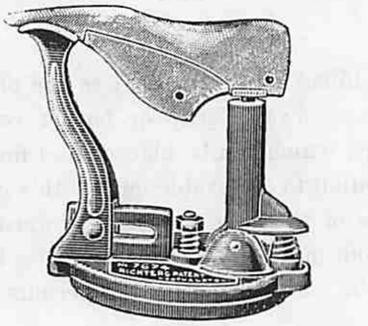


Edge Setting Iron.

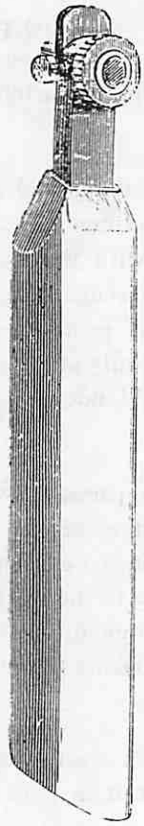
Curved Dummy.



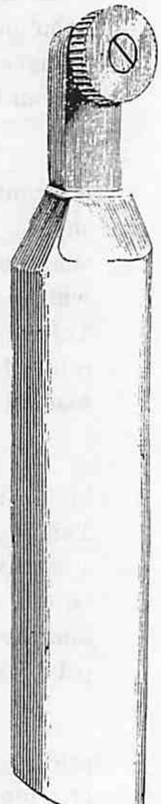
Welt Plough.



Lasting Jack.



Bunk Wheel.



Fudge Wheel.

Hand Finishing Plant.

The next machine is the Stitch-Separator. The stitch-separator represents the sense of touch as near as is possible by mechanical means. The motion consists of a variable loose negative motion when lifted over the stitch, which is converted into a positive pressure action, on the pricker or marker descending between the stitches. The stitch-pricker acts as a feed, carrying the welt the length of the stitch. The lift from the stitch releases the pressure of the separator, which rises over the stitch. On it descending upon the opposite side of the stitch, it immediately presses on the welt, leaving an indention the shape of its edge. It again feeds and is lifted over the stitch and so repeats the operation.

"Hadaway Stitch Separator"—Plate 112. This is the machine that feeds the boot automatically to the separator or prick stitch, at such a rate that it is possible to travel round a boot and prick round the stitches from joint to joint in 15 seconds. When the mark is made by the separator, as explained in the previous paragraph, the separator is taken forward in the direction of the feed of the boot, then lifted up and taken back to its original position ; here it vibrates freely, and seems to almost feel its way between the stitches. When in position, it becomes rigid again, the presser lever is brought to bear on the separator, which makes a mark and is carried forward again, and so on all round the boot. Speed of countershaft, 450 revolutions per minute.

Buffing Machines, of the "Webster" type, have an arrangement of covered rods, arranged to form a cylinder, that require more than a brief reference. The end of the cylinder which holds the buffing material, consists of two discs ; these are connected by steel rods that hold strips of basil, that pass round the rods on the inner side, but which have the loose ends of the basil standing towards the sandpaper on the outer side. These strips form an elastic support for the sandpaper, and also a yielding surface that gives before the pressure of the operator, and prevents the undue abrasion of the sole.

The sandpaper cover is cut in the form of two right-angled triangles, joined at their bases ; these bases being equal to the width of the buffers. The method of attaching these is to first fasten one of the apexes, then wind the paper round and secure the other apex. This produces a spiral joint on the surface of the cylinder and secures the paper.

A recent development of this idea is the substitution of rubber strips for the rods and basil. It is claimed that the effect is to produce a better surface, and to greatly increase the life of the cylinder.

The usual motion is one of ordinary revolution in one direction. With this type of machine the operator is expected to impart to the shoe being buffed a side motion, so that the total effect is to apply a rotary motion to the surface being treated. Messrs. Jackson and Pochin have produced a machine—(See Plate 109)—that produces a combined rotary and oscillating motion ; that is to say, the cylinder rotates and also oscillates side ways, thus producing the effect of the movement of the operator on the ordinary machine. By the use of this machine the operator simply presents the surface of the sole straight on to the buffing surface of the machine, without any movement beyond the drawing motion required to present all parts of the bottom to the buffer.

The manner in which the bottom of the shoe has been levelled has considerable effect on the mode of scouring or buffing the bottom ; as a rule, the waist, or shank, is scoured off with the

"Naumkeg." This machine permits of the operator buffing out the depressions and awkward places in the sole or waist. Where the preparation of the bottoming parts has been done badly, or where the sole is unlevel from any cause, it is common for the "Naumkeg" to be used for the whole of the bottom. In the American factories it is quite common for the whole bottom to be scoured on the "Naumkeg"; but, as a principle, the forepart should be buffed on the "Webster," or other bottom buffer, and the "Naumkeg" used for the shank or waist only.

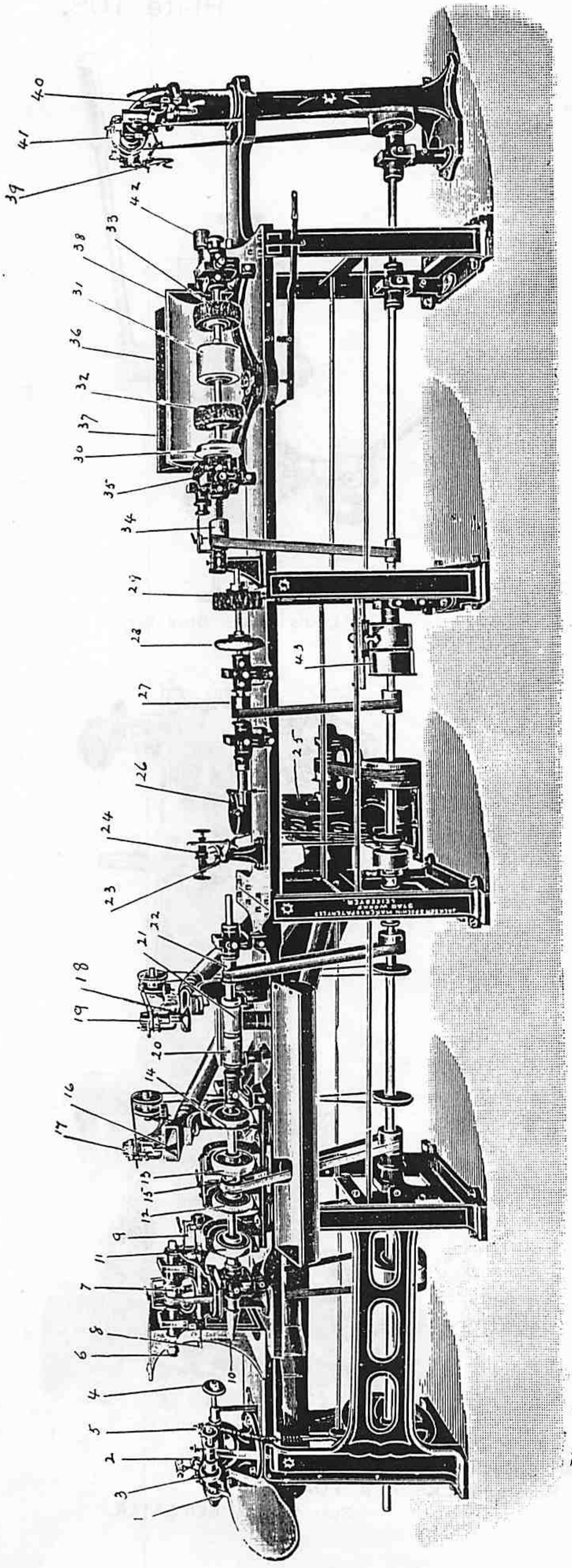
"The Fudging Machine" comes naturally next. This consists of a wheel which has the impression required on its outer surface, and is mounted on a spindle, with the revolving loose wheel or guard and vibrating marker. A small spring control table pushes upwards towards the marker; it is depressed by a lever and foot treadle. Upon the pedal being pressed, the table descends sufficiently to permit of the boot having the welt adjusted under the fudge wheel. As the welt is drawn against the fudge wheel, the power which makes the impressions is formed by the grip of the table against the sole of the boot.

We will assume that the edges and heels have now been inked, and the process of finishing the heel would depend very much upon the class of work. Heels may be finished upon the pads and brushes, in which case the shoe would now go straight to the edge setters and on to the pads and brushes. Assuming that it is preferred to have the heel burnished, the process would now be burnishing. Heel burnishing machines either carry a glazing iron round the heel ("Tapley" action), revolve a block, or combination of loose metal plates, representing the shape of the heel ("Baudry" and "Expedite") or apply the friction from the top-piece to the seat ("Rockingham" action). In the case of the "Tapley" burnisher, the boot is jacked, and the burnisher, which is a form of a heel dummy used in hand finishing, is set in a carrier. This carrier is connected to a motion that makes a circular action, carrying the carrier from the side to side of the heel. The pressure of the burnishers towards the heel is by a spring, which adapts itself to the curve of the heel as the burnisher is carried round. This produces a very good finish upon heels that have a great deal of curvature, but has a tendency to put extra pressure on the parts of the heel that depart very much from portions of a circle. This causes the burnisher to have a tendency to mark the sides of the heels in men's work.

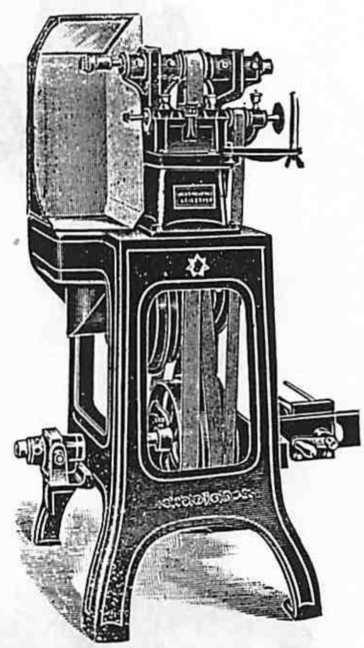
The "Tapley" has a tendency, unless carefully used, to roll over the corners of the heels, so spoiling the shape of the heel. They also have the bad habit of crushing the seat unless care is exercised.

"The Expedite Burnisher" is without doubt the fastest machine of any type of heel burnishing apparatus. Its motion is very similar to that of a heel trimmer, and the capacity of the machine is only limited to that of the operator. The head will burnish the heel as fast as the operator can put them up to it. The working parts of the machine consists of a cone representing the shape of the heel. This cone is formed of a number of metal fingers, which come alternately into contact with the heel as it is burnished, and so form a combined rubbing and tapping motion. The cone is fitted on the end of a spindle, the top-piece of the heel being revolved upon a guard fitted to side of machine. The heel wax is fed on the cone by a revolving disc, which turns on a spindle in the wax trough. The disc is heated by a jet of gas, and the amount of wax deposited by the disc is regulated by its distance from the cone. A small brush is fixed above the cone, which spreads and distributes the heel wax on the top of the cone; this keeps the wax evenly all over the heel.

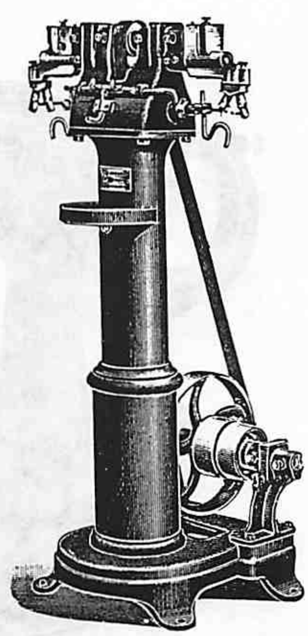
Plate 107.



Combined "Finishing Plant" Bench.



Self-Oiling Edge Trimmer.
(Patent.)



Self-Oiling Edge Setter.

Finishing Machines by

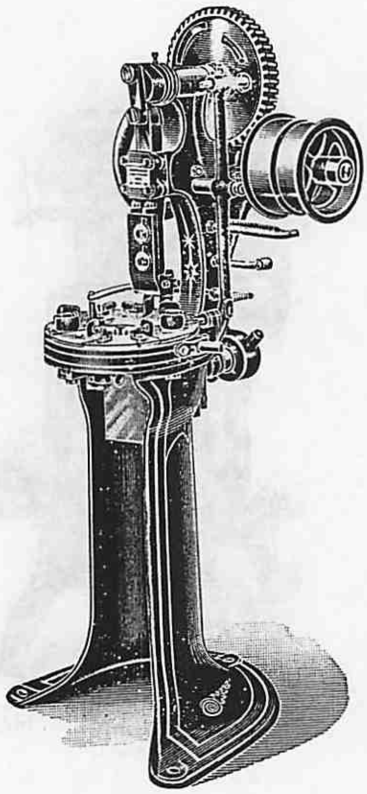
Messrs. JACKSON & POACHIN,

Star Works,

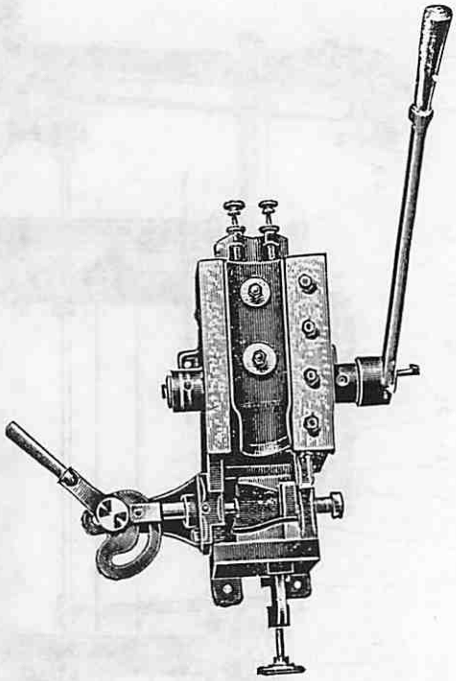
Humberstone Road,

LEICESTER.

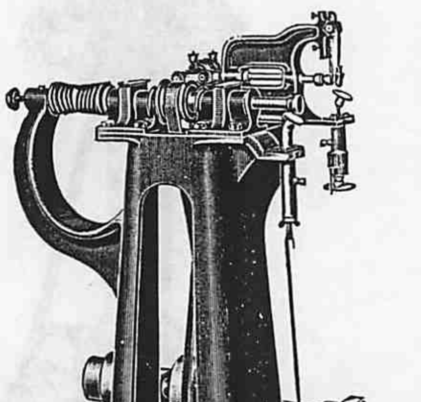
(See Plate 207).



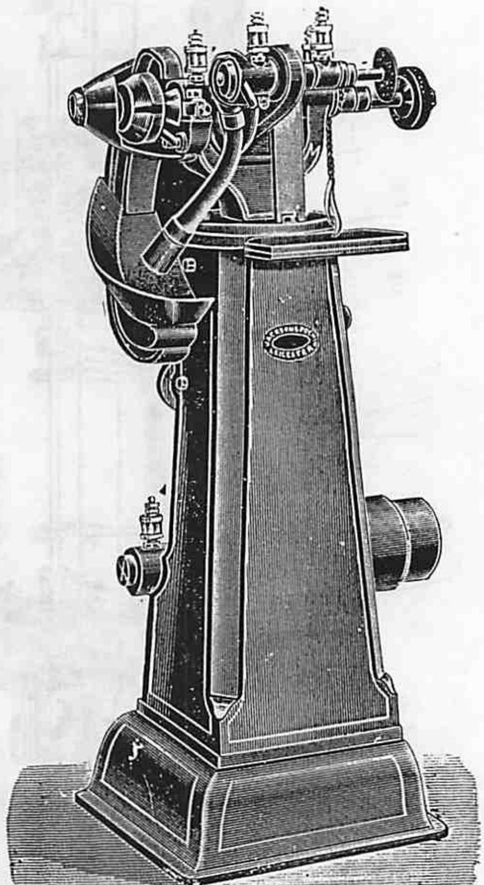
Power Heel Breaster.



"Louis" Heel Breaster



Combined Welt, Edge, and Channel Machine.



Heel Parer.

Heel Breasting, Combination, and Heel Paring Machines,
By Messrs. JACKSON & POACHIN,
Star Works, LEICESTER.

(See Plate 208).

The operator holds the boot much the same as for heel-trimming. He puts the top-piece against the guard, the side of the heel being against the burnishing cone. The boot is now turned over, keeping the surface of the heel against the burnisher until the opposite side of the heel is burnished, it is then finished, the operation being repeated. The average operator will do about 1,400 pairs a day.

"The Rockingham Burnisher" traverses the heel from the top-piece to the seat, either the heel revolving and so presenting each part of it to the burnisher, and being forced towards the burnisher with a spring, or the burnisher has a double motion. It revolves in relation to the side curve of the heel, but reciprocates in relation to the height of the heel. This machine does fair work on heels with little curvature, but has a tendency to push the lifts open on curved heel work.

This type of machine depends upon friction for its heat. The movement of these machines is from the top-piece to seat of heel, up and down the heel as distinct from the Tapley type side to side movement.

Speed of heel burnisher about 150 revolutions per minute. Capacity of single burnisher from 300 to 400 per day. The capacity in this varying according to the number of times burnished, if twice burnished, a second application of ink is necessary.

Slugs, studs, or other heavy metal insertions require grinding. This is usually done upon a sandpaper wheel, about 6 inches wide, mounted upon a shaft. This shaft also carries a sandpaper pad for smooth grinding after the emery. These have a tendency to press down upon the relatively soft leather and to take away the edges of the slugs or studs, leaving them somewhat round. For very good work it is some advantage to file the slugs.

Burnishing tools produce their result by friction. This may consist of burnishing and consolidating the fibres of the leather, the effect being assisted by the use of heat and special inks; or of merely producing a polish upon a preparation previously spread over the surface. Generally, modern edge-finishing consists of a combination of these two principles: the edges of the soles are burnished and the surface of the heels polished. In some cases, the actual friction between a solid substance and the edge required in burnishing and polishing, is superseded by the use of brushes, which simply produces gloss upon a preparation containing some compound of gum or shellac; this is termed a brush finish. This does not imply that the finish of an edge should be confined to one method. Very good results are obtained by first consolidating and hardening the edge by friction, and then applying a coloring and polishing preparation, which is afterwards brushed until the required gloss is produced.

The finish of the edges of the soles is generally made by friction, either from a vibrating tool, against which the edge is pressed by the operator, or by the friction of a circular disc, which has its outer surface cut to the shape of the desired edge.

Vibrating Edge Setters consist of a metal block balanced on a spindle; the lower end of the block is bored out to take the setting iron; the upper portion is fitted with a force cup. This cup has a movement from an eccentric pin on a disc at the end of a shaft; as the shaft and disc revolve they produce a vibrating motion in the carrier and setter. The pace of the setter naturally travels in

the arc of a circle (see Plate 105), and the pace of resulting motion is similar to that of the sewing machine needle. The tool travels at its greatest rate in the centre of its motion, and relatively slow at each end of the stroke. The actual travel is about three-sixteenths-of-an-inch ; the length of the stroke is important, the principle being that the shorter the stroke the greater the number of vibrations required. The pressure is applied and the work held up to the machine by the operator, and steadied by a finger hook.

Most machines of this type have a double head, allowing of two operators facing each other. Naturally the motion of the machine and the alteration in the plane of the edge as it is pressed up to the machine causes a great deal of vibration. This defect, decidedly a disadvantage, has been so minimised in practice by improvements in the machine, that in the latest models it is practically non-existent.

Many attempts have been made to produce a machine that would remove the present cause of vibration, and also produce a similar motion to that of the hand setter. This has been achieved by the insertion of a reciprocating tool, which, having two setters which travel in different directions over a small area, do not set up vibration, and yet do produce a *facsimile* action to that of the hand setter.

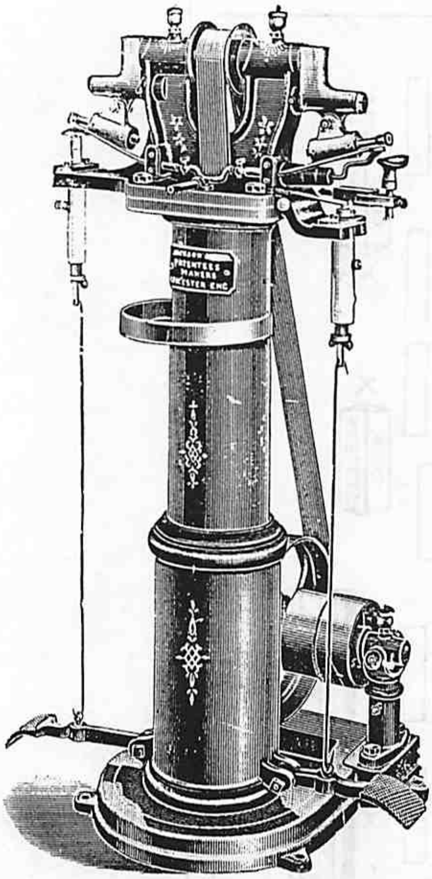
A description of "The Regal," the latest development in the motion of vibrating setters, will help to explain the action of those generally in use. The illustration of the section of setters on Plate 111, shews the setting iron held by the tool holder which derives its action from the shaft. If no provision was made to take the upward thrust of the operator, all the force would be sustained by the end of the shaft and the bearings. But the tool holder is acted upon by a rod that is thrust downward by a spring that is attached to a separate arm upon the machine frame, and therefore, the upward thrust of the worker is taken by this separate arm and not by the end of the shaft. The travel of the tool is shewn on Plate 105, and has been explained.

In this machine, the vibration common on machines of this type is practically removed by substituting a swivel at the end of a long shaft, which is slightly out of centre at its driving point for the usual pin and eccentric. This produces a vibrating motion in the tool without the usual vibrations in the mechanism and the frame of the machine. The vertical section shews the pivot in the tool holder shaft and the relative length of the vibrating shaft. The horizontal and vertical sections of the working parts shew the motions that contribute to produce the vibration of the tool.

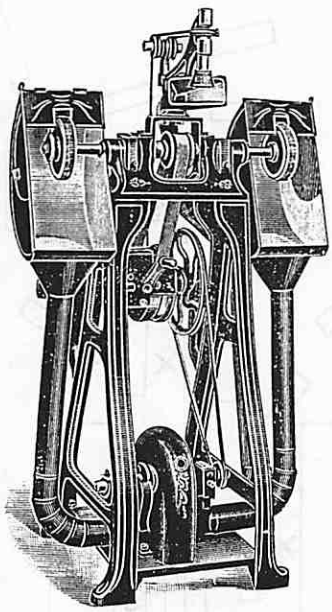
A rotary edge setter has been in use for a considerable time, known as the "Baudry." The machine has a rotating block, in which the outer edge represents the shape of the desired edge ; the motion of this block against the edge produces sufficient friction to polish the wax ink applied. The effect is that the ink is spread, and the fibres of the leather laid down. The general shape of the machine permits the boot being placed upon a jack, the operator drawing the tool, which is swung from overhead gear, towards the boot.

Wax inks should be dry upon the surface before padding, the friction of the pad simply glazing the wax ; if the solution is not dry the pad simply wipes the wax off.

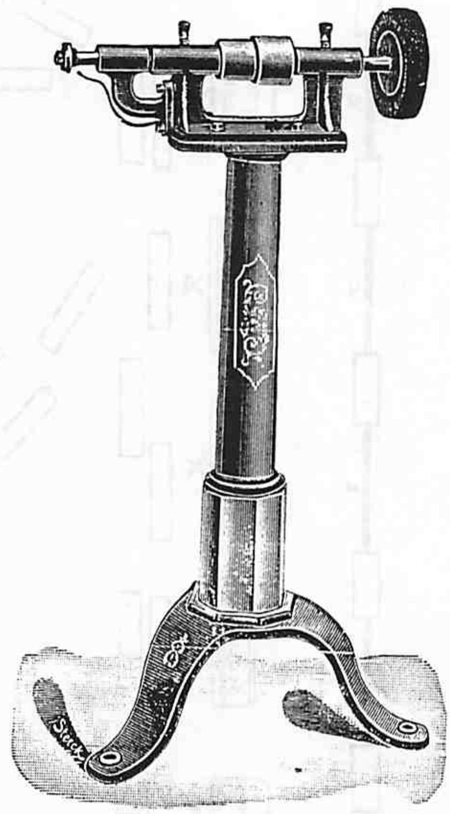
Paints should be put on with a good camel hair brush. They must be applied by drawing the brush in one direction, with as few strokes as possible, and without bubbles. Best quality paints may



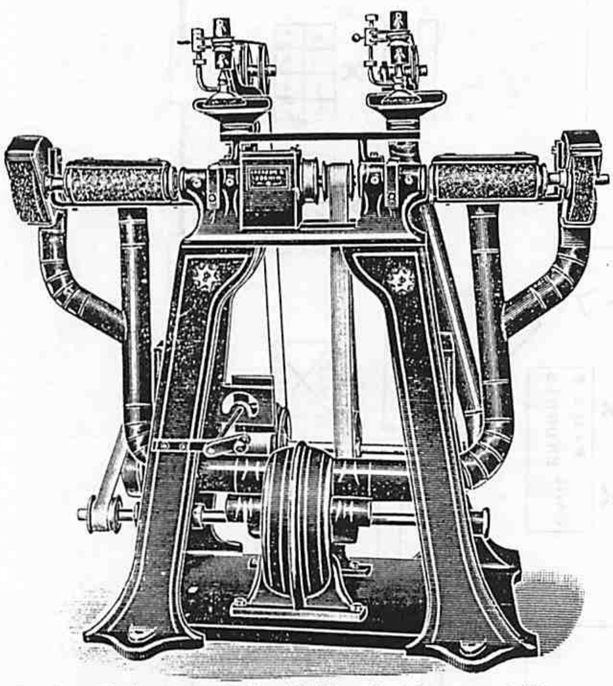
Combined, Bunking and Stitch Wheeling.



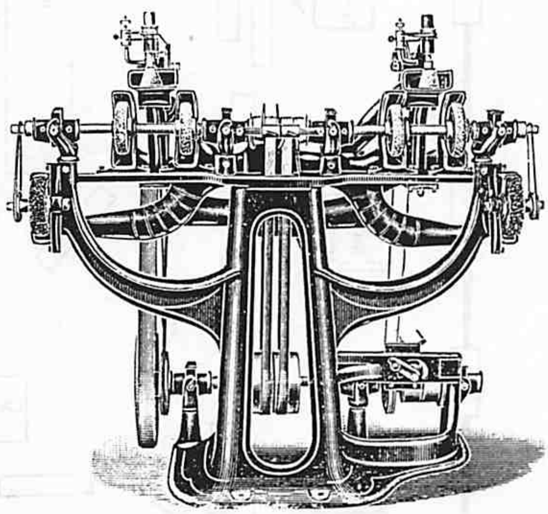
Heel Scourer.



Seat Wheel.

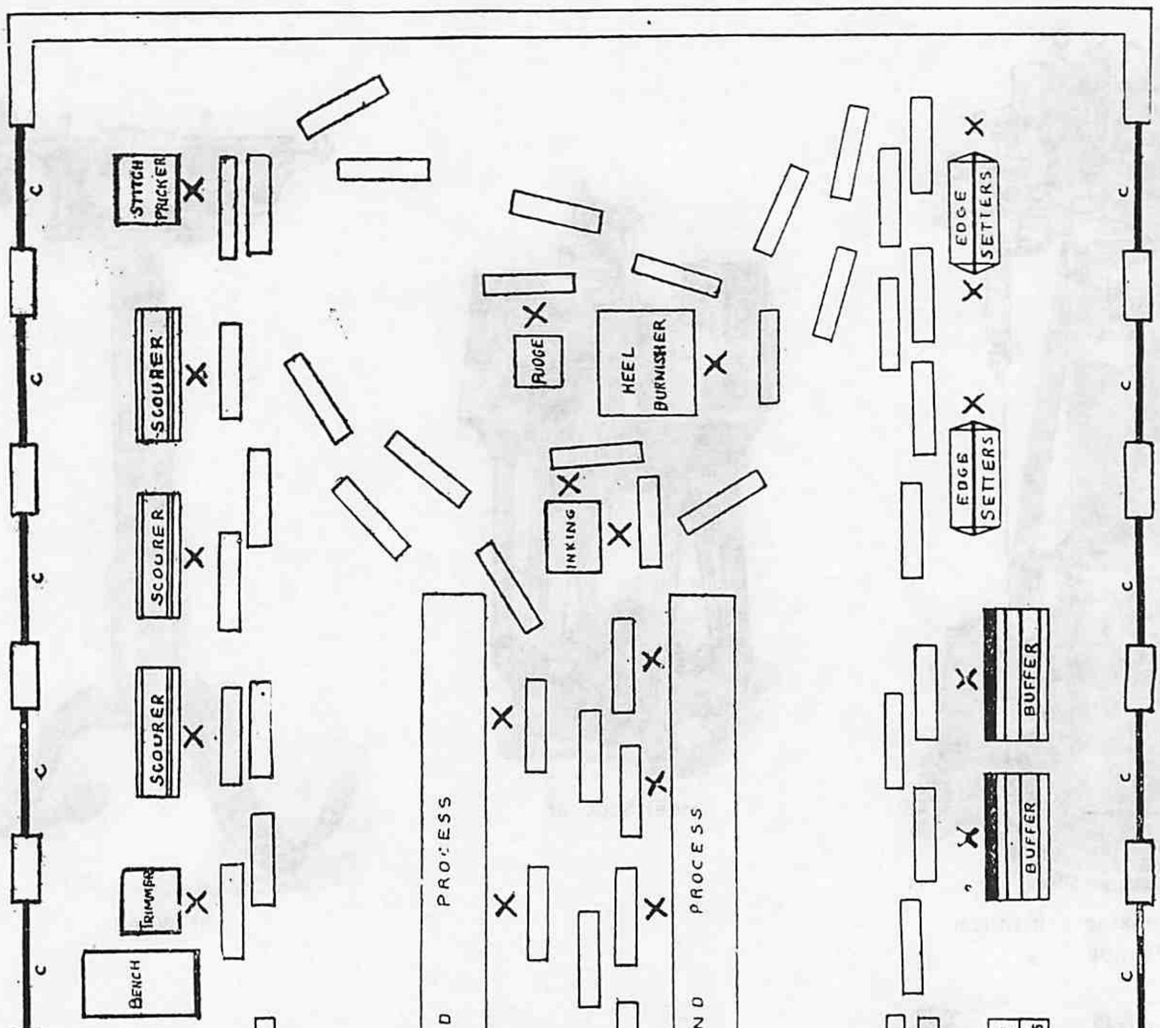


Double Rotary and Oscillating Bottom and Waist Scourer.



Double Heel Scourer.

Wheeling and Scouring Machines,
By Messrs. JACKSON & POACHIN,
Star Works, LEICESTER.



Plan of Machine Finishing Room.

be boned by hand, and then brushed by machine. But, as a rule, all paints are finished on the white pads and brushes.

Transparent or gum finishes consist of the application of solutions of gum and some colouring matter. These may be spread by machine, being applied by hand and simply put up to the pad, which will distribute the solution quite as well as it can be done by hand. So far there is no substitute for boning up the gummed bottom by hand, although this boning is a very old-fashioned hand process.

Paints, or Sloshes, can be used to produce finishes of many grades of quality; some of them very common, some nearly as good as the best hand method. In common work the paint is put straight on after the buffing, and is then brushed up by machine. A really good bottom can be secured by first applying a coat of gum after the buffing, and then putting on a thin coat of paint. The application of this coat is quite an art. The brush should be held so that the hairs scarcely touch the surface of the bottom, and the liquid is floated on like water. The result is a water-like surface that is not equalled by any other means. As a general principle, the less paint, so long as there is a surface, the better. A thin coat is less likely to crack, less likely to work up in the after processes, and less liable to damage. The best finishes should be first gummed, which produces a surface for the paint to stand on, and should be boned up after painting, the final touch being put on by the brush.

A finish is also made by the use of shellac inks, but, unless a resist is first applied, much of the polish is absorbed by the fibres of the leather.

Shellac finishes are simply varnishes which, upon the drying of the solution applied, leaves a coating of shellac on the surface. In practice, it is found that however fine the edge may be after trimming, the fibres always absorb most of the shellac, either leaving a dull finish, or requiring more than one coat. It is probable that a solution of gum placed upon the edge, and allowed to dry, before the application of the shellac ink, would help to keep the lustre.

The use of shellac inks have not been thoroughly tried at present; as mentioned, the difficulty appears to be the absorbing power of the leather. If a bright finish was required, such as a shellac would produce, the trimmed edge should be treated with a gum, or with a gum ink or stain; if this was set, by running round a rotary iron the shellac would set on top, producing a bright, but rather glassy service. There is no doubt that some experiment is required in this direction.

Machine Seat Wheels, or Heel Keying, consist of an impression wheel working against a guard. The shoe is put upon a movable spring jack, which permits of the heel being rotated against the wheeling block. In operation, the side of the shoe, after being jacked, is placed against the wheel. The toe of the shoe is then swung round, rotating the heel against the seat wheel, and producing an impression.

Seat wheeling by machine commonly has the defect of being carried too far along the side of the shoe, this being very difficult to avoid, the operator not having sufficient control over the process to stop exactly at the correct point. For very good class work it is advisable to perform this process by hand. The average hand worker could do about 400 pairs per day, therefore, it is scarcely worth while having a defect when the cost is so low as this.

The usual bench work in the machine finishing shop is included in the description of the hand method. The embellishment by crowing, marking, and wheeling in fancy figures has to be done by hand. This should be done in the best style or let alone, a well executed embellishment is an ornament, a badly executed device is a defect; the special merit of the finish of good class American shoes consists mainly of the excellent manner in which these small points are executed.

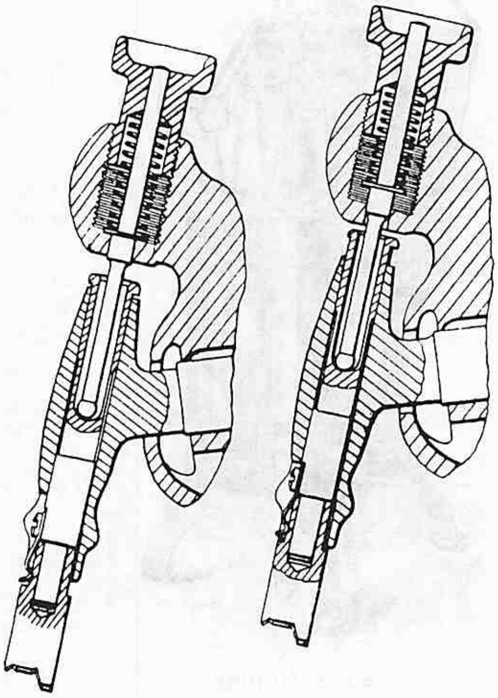
A final process of cleaning the bottom and edges from dust and dirt, completes the operations of the finishing department.

The final processes of cleaning cannot be ignored, the wax inks always set on the studs and slugs, and must be cleaned off. At present, there does not appear to be a machine that will do this quicker than it can be done by hand. The usual method is to scrape the ink off with a square-edged knife, and then to clean the top-piece and heel with the rag pad. From this process the shoe should go to the embossing machine for stamping with trade mark or other device (see plate 90).

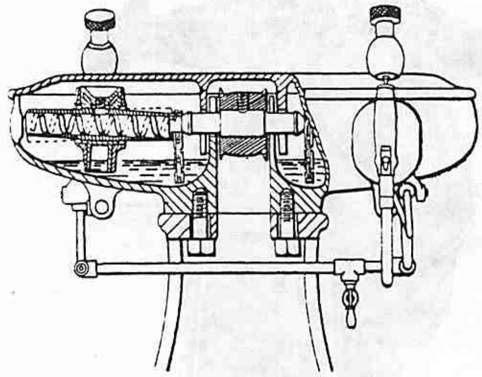
The general arrangement of a set of finishing machines will be found illustrated upon Plate 107. This represents "Jackson and Poche's Combined Finishing Bench," and includes most of the machines commonly used in the finishing room, and the order in which they are placed. The numbers given refer to the numbers on the illustration.

No.	*Name of Machine.*	*No.*	*Name of Machine.*
1.	Heel Parer—"Smith Holder"	23.	Edge Cutter Grinder
2.	Pulley for Heel Parer	24.	Pulley for Grinder
3.	"Rand Cutter"	25.	Dust Fans
4.	Emery Wheel, for Cutters	26.	Seat Wheel and Garth
5.	Disc Emery, for "Rand Cutters"	27.	Pulley for Seat Wheel
6.	Forepart Cutter and Shield	28.	Cotton Heel Roll
7.	Pullies for Edge Cutter	29.	Black Heel Brush
8.	Waist Trimmer	30.	Cotton Waist Black
9.	Pullies for Waist Trimmer	31.	Cotton Bottom Roller
10.	"Louis Heel Breast Scourer"	32.	Black Brushes
11.	Fine Heel Scourer	33.	Black Brush
12.	Rough Heel Scourer	34.	Fast and Loose Pulley
13.	Round-faced Scourer (fine)	35.	Cotton Waist Brown
14.	Round-faced Scourer (rough)	36.	Heel Roll Round
15.	Pulley for Heel Scourer	37.	White Brush
16.	Breast Scourer	38.	White Brush
17.	Pulley for Breast Scourer	39.	Edge Setter
18.	Waist Scourer	40.	Edge Setter
19.	Pulley for Waist Scourer	41.	Fast and Loose Pulley for Edge Setter
20.	Fine Bottom Scourer	42.	Fast and Loose Pulley for Brown Shaft
21.	Rough Bottom Scourer	43.	Fast and Loose Pullies for Main Shaft
22.	Pullies for Scourers		

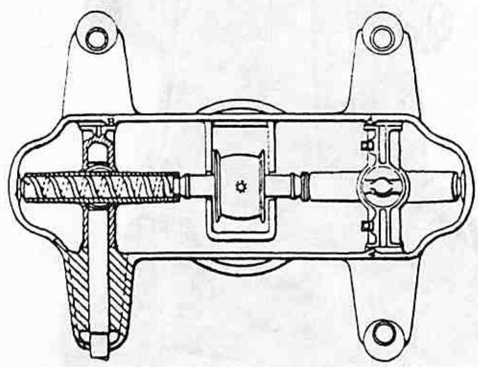
That is probably one of the most complete arrangements of Machine Finishing Kit upon one bench, and the most economical in regard to the amount of space occupied. For outputs up to about 1,500 per week, this would represent an excellent arrangement. Above that number it would probably be more convenient to have separate machines for each process.



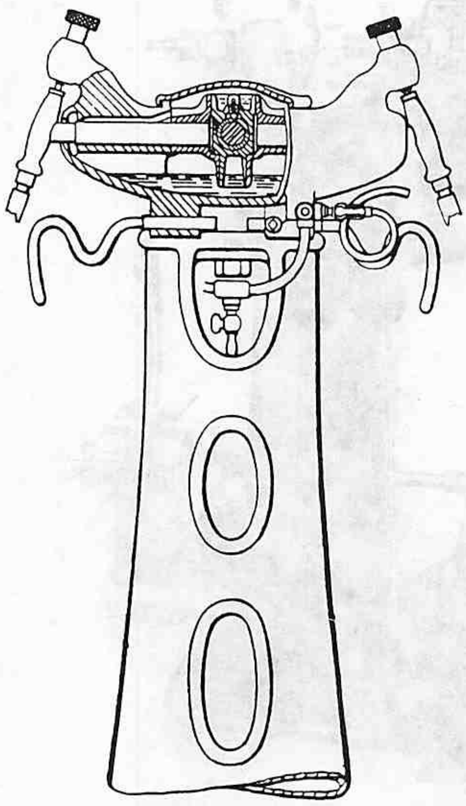
Section of Letters



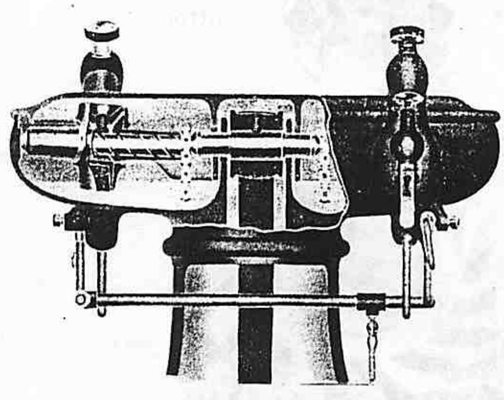
Vertical Section through Motion.



Horizontal Section across Motion.



Vertical Section through Base.



Head of Machine.

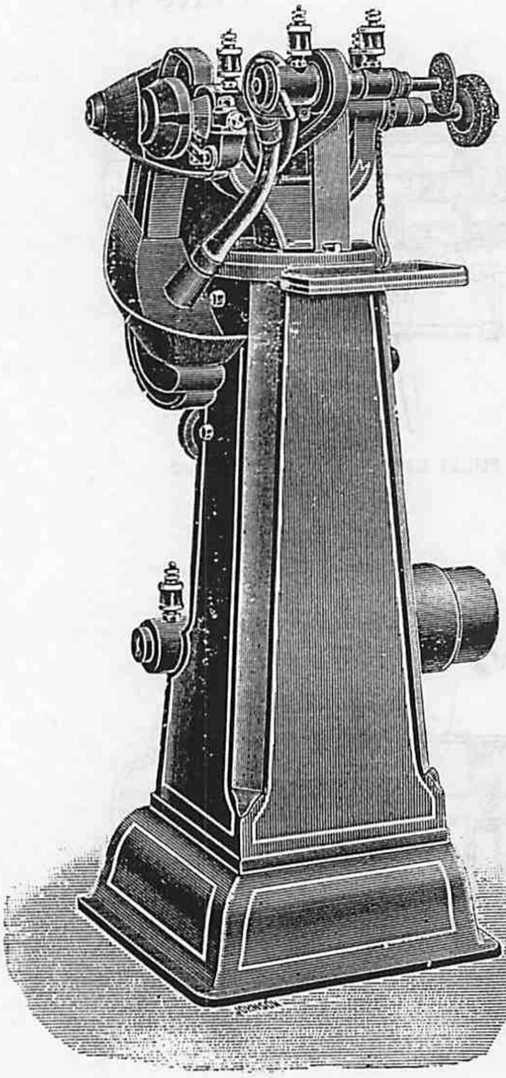
The Regal (Silent) Edge Setter, by

THE BRITISH UNITED MACHINERY Co.,

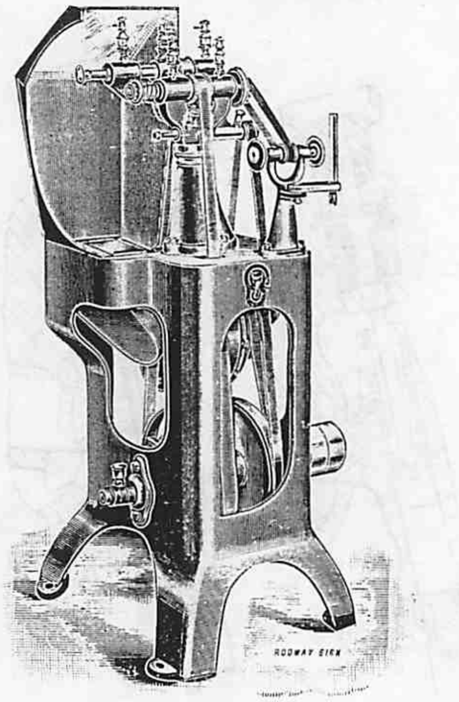
Union Works, LEICESTER.

To face Page 211.

Plate 112.



"Smith" Heel Parer.

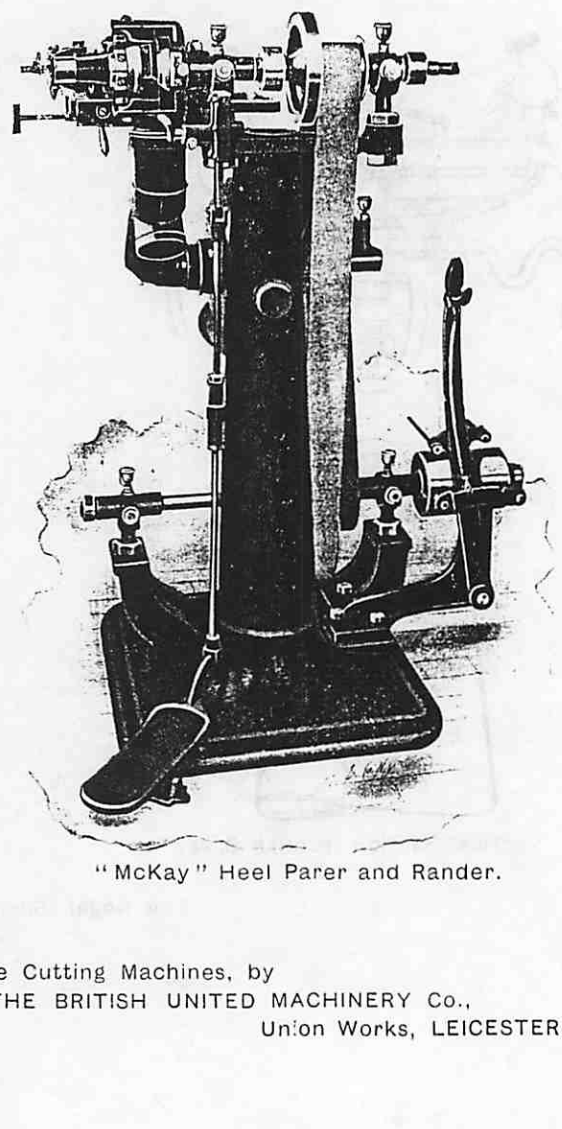


Edge Trimmer.

Waist

Cutter.

Forepart Cutter.



"McKay" Heel Parer and Rander.

Heel Paring and Edge Cutting Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

(See Plate 113.)

The main shaft of this set should run at about 675 revolutions per minute. The pullies attached to each machine are set to make the best pace for the special machine taking the number of revolutions made from the main shaft. The two kinds of brushes have separate shafts, and are centred from a turret edge that revolve so that either set can be brought to the front, where it is held in position by an automatic stop. By this means either black or brown work may be finished on the same bench.

"The Power Heel Breaster," shown upon Plate 108, should have the driving shaft running at 425 revolutions per minute. This will breast at the rate of about 18 heels per minute; it is not advisable to run any faster. The first operation is to adjust the guard to suit the amount of waste that has to be cut away. This guard spindle may be raised or lowered, and is held in position by a wing screw. There is also a special screw for retaining the guard in proper position. The heel is held in position by self-adjusting clips. The heel being forced in position up to the guard, these clips may be regulated by the screws, after the heel has been placed in the centre and the clips brought up to it. This is then used as a standard for the heels of the same size. By a special arrangement of the screws the clips may be set back for larger heels. The table moves by four movements. As the holes come into place the heels are fed in the front of the guard, each movement of the table brings a heel under the breasting knife. The movement of the buffer breasts the heel, the breasted heel is thrown out of the machine, and the table takes a quarter turn, and the operation is repeated.

"The Seat Wheel.—(See Plate 109). The operator holds the toe with one hand, and the back of the boot with the other. He then places the seat on the quarter piece, starting from one side of the heel and working right round the seat, finishing at the opposite corner. The action is formed by the operator using the hand that grasps the seat or back of the boot as the spindle with a side motion. This hand moves as the toe of the boot is turned completely round, bringing the edge of the seat in contact with the tool. This wheeling is done hot, as by the hand, a special gas jet being provided, as in most hot-kit finishing machines.

"A Combination Machine" is shown upon Plate 108. This is a combined Channel Closer, Edge and Channel Sleeker, Welt Opener, and Tapping-up machine. The operator holds the boot under the vamp and rubs the underneath side of the roller against the edge of the boot. This roller is provided with two sets of wings, which rub outward and lay the channel. Edge sleeking may also be done upon this machine. The lip of the sleeker passes along the edge of the sole and sleeks down the channel, making the edge square and the channel perfectly level with the sole. This machine is also fitted with a welt opener, which has a revolving tool which acts upon the welt, the upper being protected by a guard. The action of the welt opener is regulated by a nut allowing an alteration to be made for light or stout foreparts. After the welt has been opened, the following operation is to tap up the edge. This automatic tapper can be regulated by the degree of pressure the operator places upon the boot. The firmness in which the boot is held to the tool decides the power of the blow. The counter-shaft for this machine would run at about 275.

The Finishes, represented on Plates 101, 102 and 103, are only types of an almost infinite variety of possible differences in the ornamentation of the bottoms of shoe-wear. It does appear that much time and money is wasted upon a part of the shoe that is so treated that directly it is used most of the finish is immediately destroyed. But we have the fact to face that the public expect to have an embellishment of the bottoms of their shoes that is, at any rate, equal to that of any other part, and which is often far more artistic.

The ladies' wing waist represents a style that admits of some very nice variations ; the waist portion may be black, or in any tone of colour that is in harmony with the top. We have not recently stitched tops with colours, but we may do so ; in that case the waist of this shoe may be coloured to be in contrast, or to match the other parts. If the form of the shoe is long in the waist, the wing should be drawn under, instead of over, so that the balance of the bottom is preserved.

The black bottom, in the next specimen, may have some variety given it by making the top-piece brown, or the reverse has a good effect ; or combinations of a black bottom and white top-piece is good, although old-fashioned.

The corrugated, diamond-waisted shoe is an expensive but very nice style ; there is no limitation to the possibility of variation in this style ; the substitution of fancy crows for the marking iron would produce beautiful effects. This specimen is represented with a tan forepart ; it may be with white forepart and black waist, or with tan waist ; or white throughout, with fancy corrugations. Indeed, the limits of the variety are only limited by the cost of the get-up. The peaked strip on one waist only has a peculiar appearance in single shoes, but it makes a good finish where the waist is square to heel on the outside, and the shoe or boot light in substance. It has been used upon medium class light work, and on hunting boots.

The heel-less slipper, or dancing pump, should be finished buff bottoms ; that is, simply have the grain scoured off and the bottom buffed up, using some coloured ball to get the desired shade. Some finishers run the lip of the iron round the edge to give a smart appearance.

The long fish-tail fiddle should be of decided character ; the waist should either be very delicate in shade, or should be striking ; that is, either blend or be in contrast.

The men's finishes, on Plate 101, do not admit of so much variety. The wide-welted stitched-aloft boot has had the stitches chopped, or janked up. A good variation may be made by making either the bottom or the top-piece black. It is not good shoemaking to raise the stitches above the level of the sole ; they are submitted to too much wear. These bottoms should be burnished with a warm iron, as shown on Plate 105. For methods of making the bottom see Recipes.

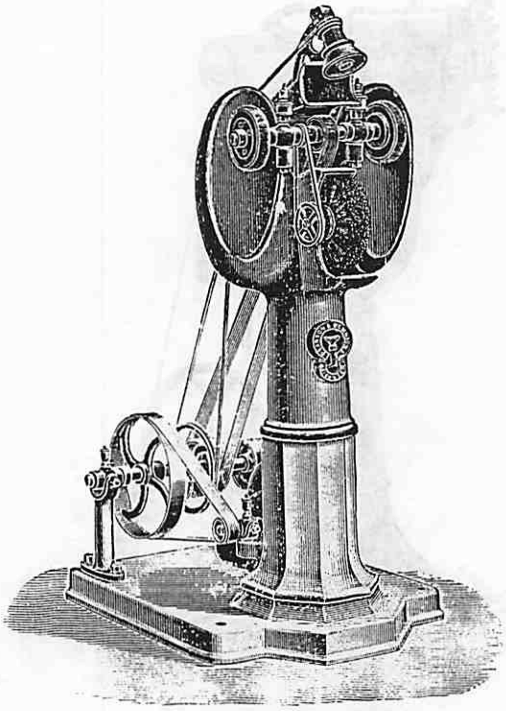
The black waist and white forepart is an old, but good style of finish, for a man's light boot. The top-piece should be either blinded on, or fastened with brass, slugs, pins, or rivets. Where iron is used for this purpose, the finisher has trouble with the stains set up by the action of the iron on the acid in the leather. If there is no serious objection, it is advisable to have a coloured top-piece if iron is used.

The light stitched aloft sole has a bunk wheel run round to set up the stitches. This is a good contrast in a heavy wide-welted boot, but liable to appear too elaborate.

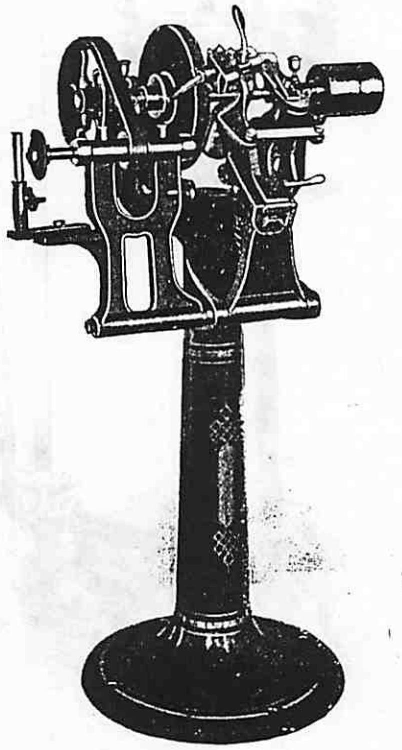
The square strip white bottom finish is a distinguished style for very light welted work ; the strip should be black ; the top-piece preferably coloured. As in all other styles of finish, variations may be made, and quite different effects secured. The bottom may be finished white, as shewn, or made out in gum, as a fiddle, with the top-piece white or black ; several variations may be obtained.

To face Page 212.

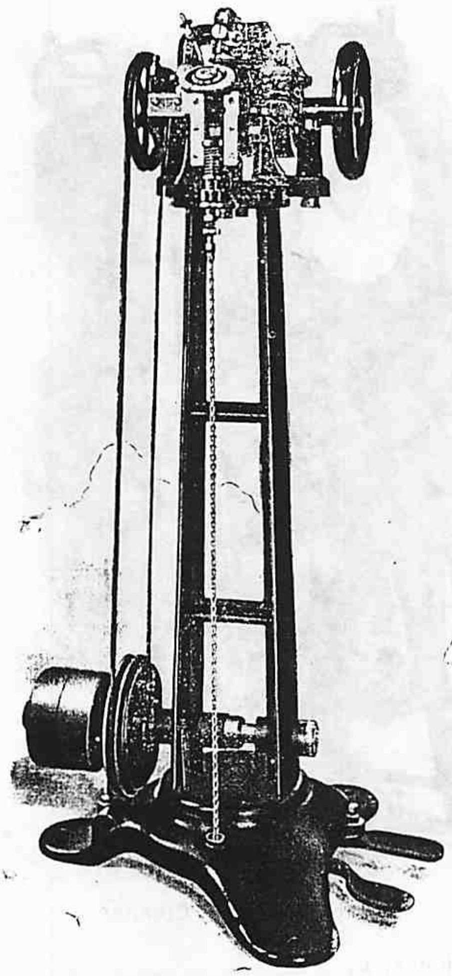
Plate 113.



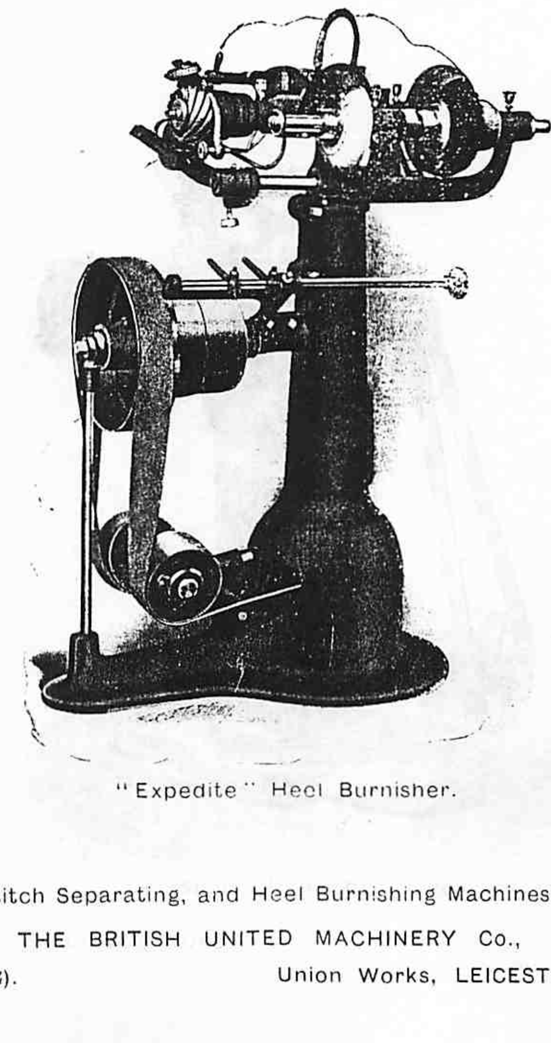
Heel Scourer.



"McKay" Knife Grinder.



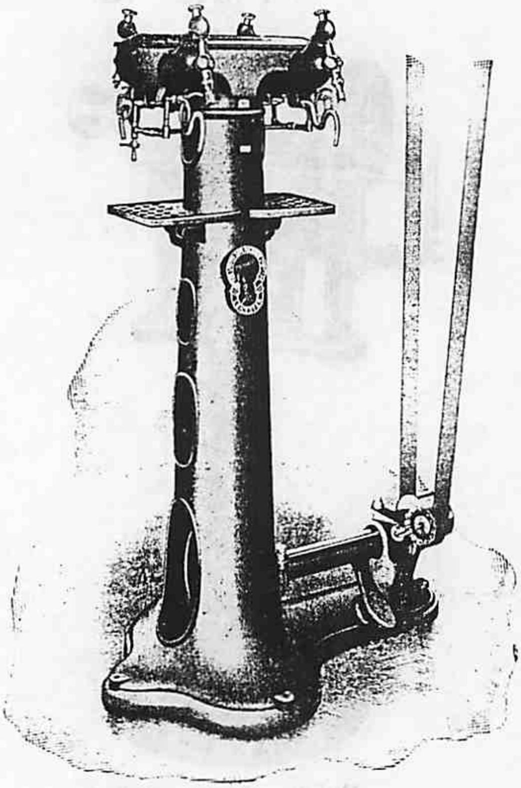
"Hadaway" Stitch Separator.



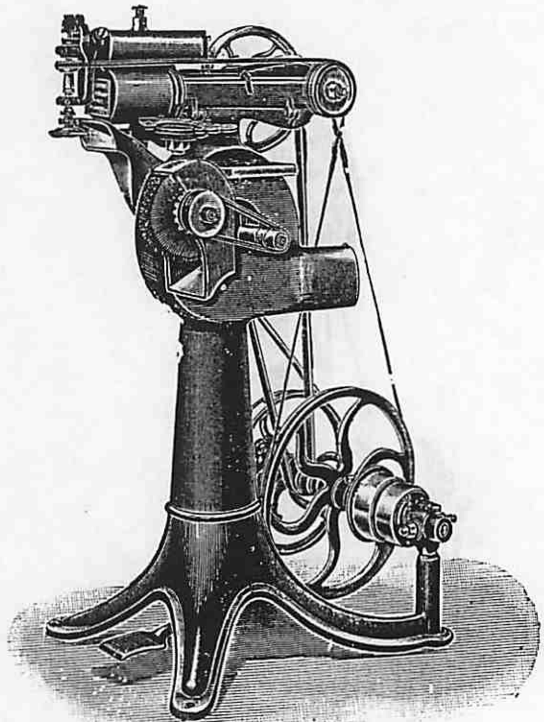
"Expedite" Heel Burnisher.

Scouring, Stitch Separating, and Heel Burnishing Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

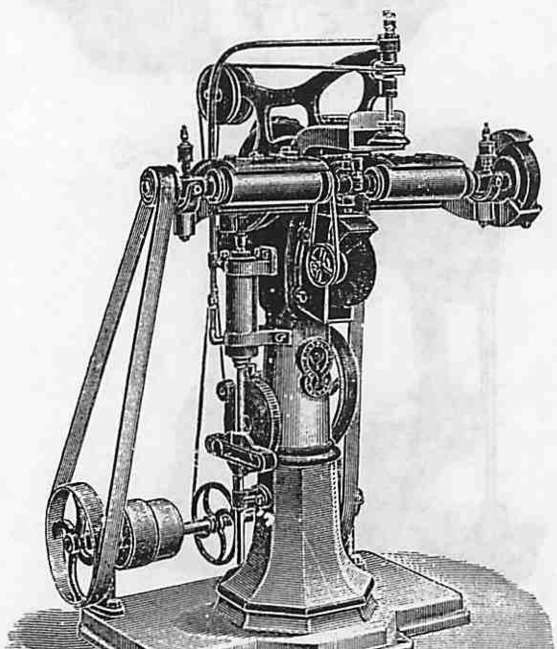
(*See Plate 114*).



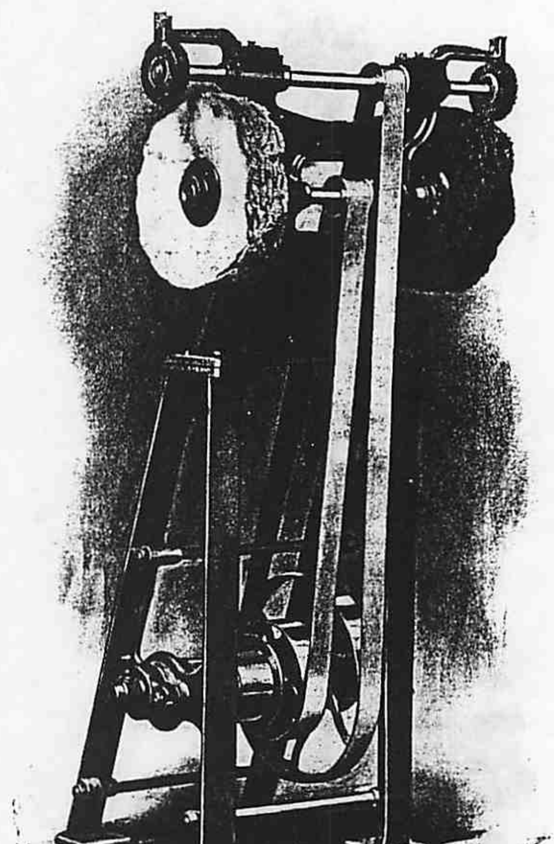
"Regal" Edge Setter.



Pneumatic Naumkeg.



Sand-papering Machine.



Upper and Stitch Cleaner.

Setting, Scouring, and Cleaning Machines, by
THE BRITISH UNITED MACHINERY Co.,
Union Works, LEICESTER.

The running shoe is included for the purpose of contrast; the forepart is usually finished rough buff grain, and the waist simply gummed and boned up, or finished black. Corrugated waists always represent a high-class finish, through the expense of the corrugations. But no attempt should be made to secure this finish unless the details can be executed in a good style; a badly executed waist of this character has a very bad appearance. If done in good style, the waist is supposed to represent some degree of elasticity, in fact, it was the only provision made for securing this peculiarity in a much advertised brand of several years ago.

Plate 102 represents different classes of welts; these are produced in many varieties, but may be divided into stitched and fudged foreparts. Stitched welts are produced by the attaching seam between the welt or middle sole and the outer sole, or by its imitation. Fudged welts are simply the indentions made by a tool which is supposed to imitate stitching, or the indentions between. Pricked up stitches are produced by an insertion between each stitch made by an awl or awl-like tool, representing the prick up. In some cases a combination method is used, the stitches are separated by a fudge wheel, in addition to being pricked; in other styles the stitches have a mark or indention made between each stitch or alternate stitches. These marks should reach from the edge of the wire or crease on the edge of the welt to the feather. The ordinary fudge is represented by indentions only, as shewn; but special apparatus is made to produce an impression on the surface that represents in shape and colour the appearance of stitches. In the working of welts, much may be done to improve the appearance by careful preparation; the stitches should be carefully cleaned and gummed; the grain of the middle should be cleaned where any shade of colour is wanted on the welt, and in all cases the character and the surface of the leather should be suitable for the finish.

The various types are fairly represented by the seven specimens. The fudged welts simply represent different widths and styles of fudge wheels. The stitched welts represent different styles of finish and of proportion of feather. The previous remarks will explain the style.

The variation in the width of welt requires some explanation; it is commonly assumed that a welt should shew the same margin from the edge of the upper all round; this is no longer an indispensable point. It has been found that the best results are obtained by making some difference in the width on the feather between the different parts. For instance, the American welt has a considerable difference between the inner and the outer side. The margin on the outer side from the corner of the toe is much wider than the respective difference on the inner side. This is a good point both in the matter of appearance and for practical utility, the boot having a tendency to spread on the outer side and to draw away from the inner side, and the point mentioned provides for this.

The measurement of welts is taken from the edge of the feather, close to the upper, to the edge of the welt, when the boot is finished, the allowance for the trimming of the edge is one-thirty-second of an inch. The general grade of welt is usually decided by the measurement of the welt on the outer side; the terms being as follows :—Close welt, 1/8 inch; full welt, 3/16 inch; half wide welt, 1/4 inch; full half wide welt, 5/16 inch; three-quarter wide welt, 3/8 inch; wide welt, 1/2 inch. These differences are graded in sixteenths of an inch, and permit of any combination of widths in the different parts being described. For instance, a shoe may be full welt, with close welt at toe and inside joint.

As a general principle, it pays better to purchase findings for the finishing room than to make them. The manufacture of finishing inks and paints has become a science; and so economical

upon a large scale compared to the production of small quantities, that it is not worth the trouble and responsibility of making for a single shop. But for the purpose of experiment, and for those who may not be able to easily procure supplies, a few recipes of the simplest inks and stains may be useful.

The beginner, and it must be added in most cases the old hand as well, should have a clear idea of the importance of exactitude in the amounts used for making finishing compounds. Most finishes are variations on some stock solutions; and it is of primary importance that these solutions be constant in their nature. The stock solutions should be made in quantities, and not altered in their composition without good reason. Solutions may be made of many materials, in constant strengths; the production of tones or colour will become simply a matter of adding a larger or less proportion of the colouring matter.

Transparent, or gum finishes, are based on the addition of some colouring matter to a solution of gum dragon. The colouring material may be made of almost any dye and of some stains. Broadly, a dye is a colouring material that produces its own colour; a stain alters the colour of the material it is applied to and is altered itself. In some cases the material is first stained, and then the dye applied upon that; the stain that forms the basis is then commonly referred to as a mordant. In very many cases there is a compound action of both staining and dyeing, that in the resulting colour is similar to, but not precisely the same, as either of the agents. All aniline dyes, more or less, change colour upon being applied; but very good results can be obtained from them with care. The most constant colours are secured from wood dyes, but not in much variety.

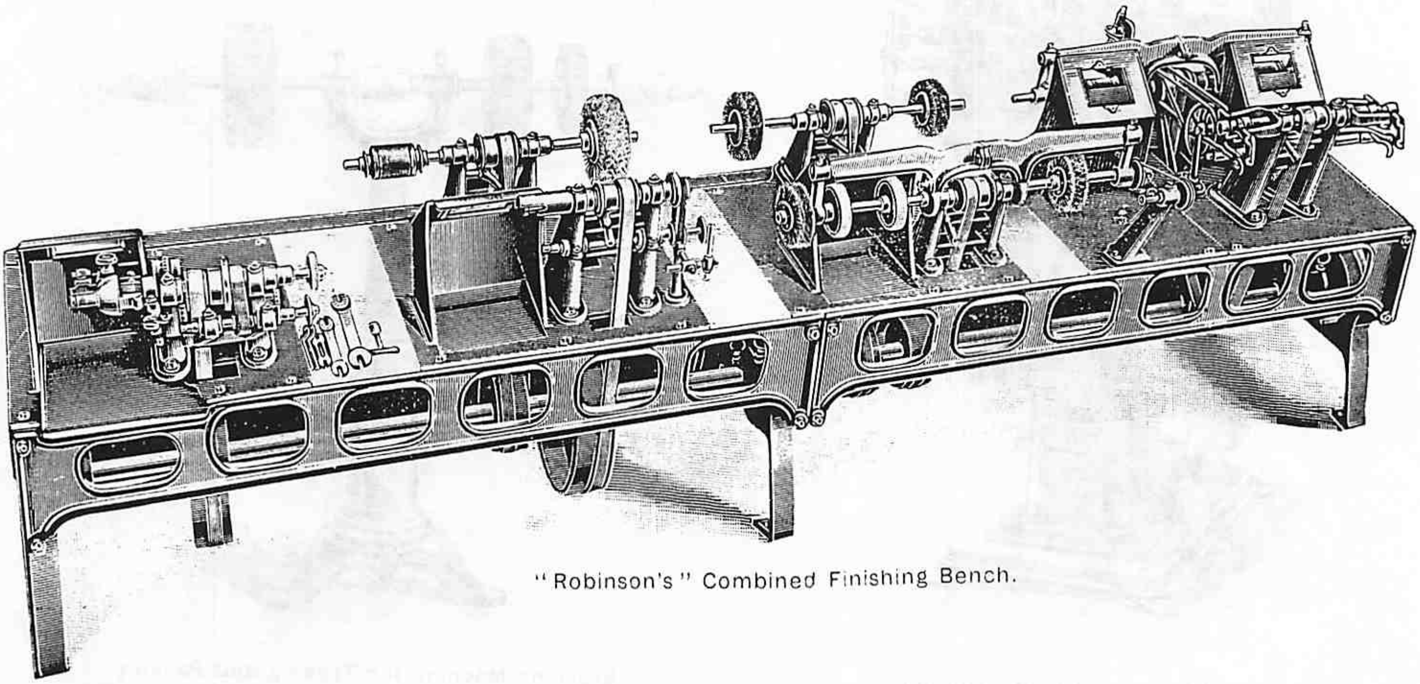
Paints, as made by the wholesale houses, consist of compounds of minerals, which set in a coat upon being "painted" on to the leather; these are made the vehicle of a great variety of colours, and, with care, blends of these colours can be made to meet any need. But the exact quantity should be entered in a book kept for that purpose, so that the reproduction of the shade or colour is not merely a matter of memory. It is not advisable to try experiments on a large scale; many of the compounds mutually precipitate, and the liquid is spoiled. Mention should be made that all vessels must be kept quite clean, and preferably should be of earthenware.

The mordants found most useful are alum in solution—1 oz. of alum to a pint of water. This is used to damp over the surface before applying gum finishes containing aniline dyes. Very weak solutions of bichromate of potassium may be used for the same purpose, or may be used in combination with gum and colours. In some cases soap and water form a good base for the colours used. But the result is always uncertain on account of the difference in the nature of the tanning of the leather; intelligent experiment is always required.

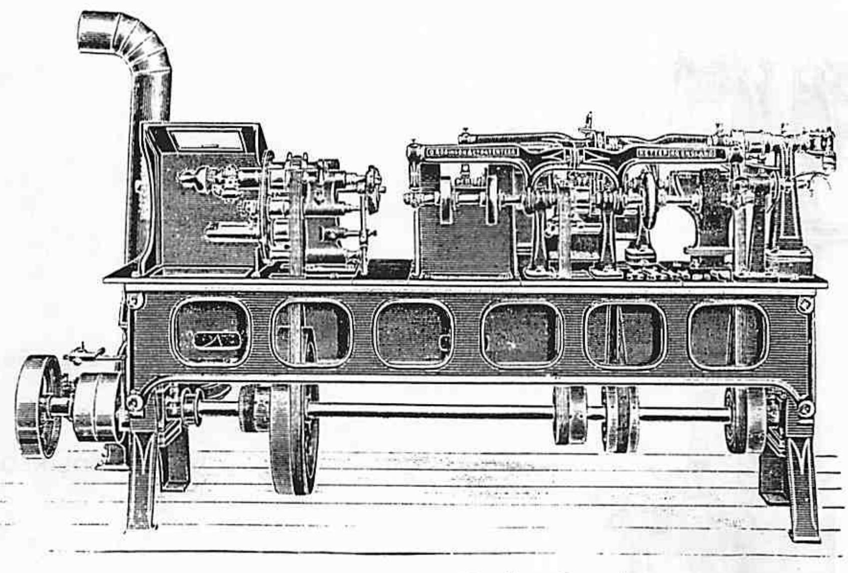
To the finisher, the different classes of leather are divided into red, hemlock; pink, mimosa; and white, bark or mixed tannages. Hemlock is either covered up by paint, or stained; the others are treated in several ways: painted, stained and finished transparent.

Stock solution for gum finish:—1 oz. gum dragon to 2 quarts of water.

Stock solutions for colours:—Fawn to chocolate, bichromate of potassium, $\frac{1}{8}$ oz. to 1 quart of water; straw to maroon (chrysoidine), $\frac{1}{8}$ oz. to 1 quart of water; brown (bismark brown), 1 part to



"Robinson's" Combined Finishing Bench.



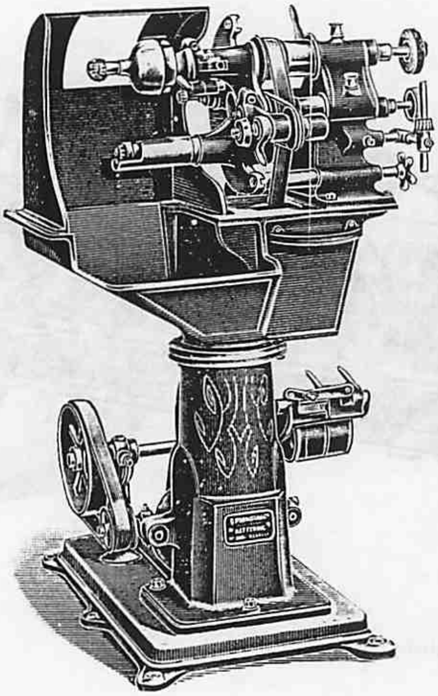
Small Pattern—Combination Bench.

Combined Machines, including all Apparatus for Finishing, by

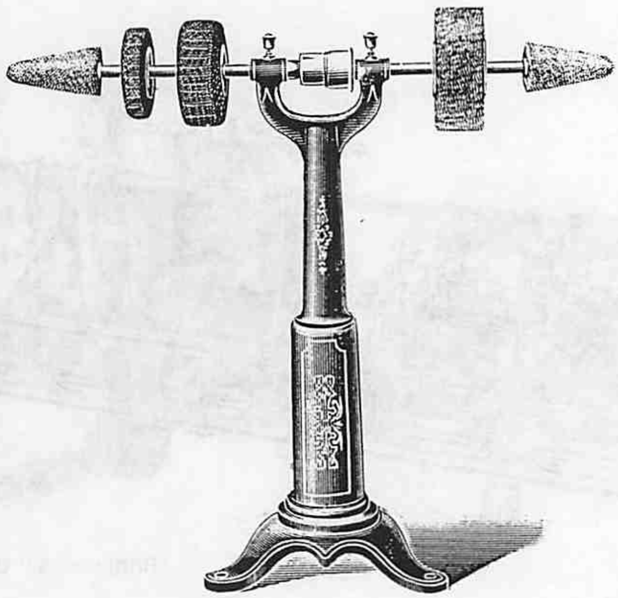
Messrs. ROBINSON & Co.,

Champion Works, KETTERING.

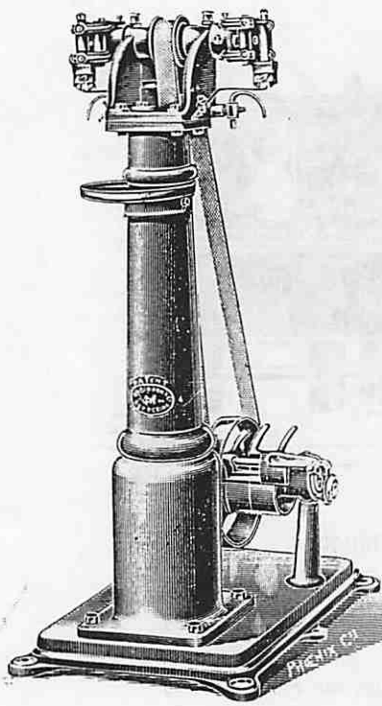
Plate 115.



Heel Parer and Seat Trimmer.



Brushing Machine for Treeing and Packing Department.



Reciprocating Edge Setting Machine.

Heel Paring and Edge Setting Apparatus.

by

Messrs. ROBINSON & Co.,

Champion Works,

KETTERING.

100 parts water ; annatto, to shade ; green, blue, violet, and yellow (aniline dye), $\frac{1}{8}$ oz. to pint of water. All these are used in combination with the gum solution, the amount being in proportion to the depth of the shade required. Where bichromate is used as part of the compound, no mordant is necessary ; but for some of the other materials a previous damping with alum water, or soap water, may be essential. This must be a matter for individual experiment.

The hand-worker may require some of the simple recipes in detail. The following may be found useful to those working alone, and as a basis for experiment :—First make the solutions in half the quantities mentioned above. Then add to each of four separate wine glassfulls of gum solution, one, two, three, four, teaspoonfulls of the colour. This will give four shades of the colour ; finer variations may be secured by decreasing the differences. A graduated glass can be bought at any chemist's shop that will assist in the matter, but these glasses must be kept clean,—a not very easy task. It is of no consequence what method of measuring is adopted if the same means are used each time. I find that it is generally easier to keep a spoon clean than a glass, but iron spoons must not be used.

Hand methods of working other colours are by scouring in the colour with some other materials. A dark green can be made by a mixture of lemon chrome and ordinary finishing ink. Primrose by cleaning the sole with weak oxalic acid, and then working rye paste or gum. Purple is produced with blue finishing ink and rouge.

Where the edges have a tendency to work up red, or be patchy, it is advisable to first make a body stain. This may be produced by first damping the parts with a very weak solution of sulphate of iron ; the compound produced is a tannate of iron, which is black. The ordinary inks may be worked on this, but the iron solution must be weak, as it has a slight tendency to dry the fibres.

Grease marks may be killed by using ammonia, but greasy leather can only be hidden up for a time, as it works through, and should be stained or finished dark. Finishing inks are wax inks, or shellac ; or combinations of stains and waxes. They are also roughly divided into one and two setting inks ; most of them contain ammonia, and should be allowed to dry before setting ; this allows the ammonia to evaporate.

Recipes for inks and washes :—

Burnishing ink :—Boil 2 ozs. logwood extract in half-a-gallon of water, then add $\frac{1}{2}$ oz. ferrocyanide, and $\frac{1}{2}$ oz. bichromate of potash ; let them stand three or four days, stirring now and then. Shellac ink : Dissolve 2 ozs. of borax in 2 quarts of water, then boil for ten minutes with 1 oz. of aniline black, add 4 ozs. of shellac, and $\frac{1}{2}$ oz. nigrosine ; boil another ten minutes.

Bottom wash :—Soak 1 lb. of glue in 1 gallon of water, to another gallon add 1 lb. of bolted pipeclay and 2 ozs. of yellow ochre ; in a separate gallon of water dissolve 1 lb. sulphate of copper (ground), 1 lb. sulphate of magnesia (ground), and 2 ozs. yellow ochre ; boil these all together, and then add 2 lbs. of oxalic acid. When cool add the previous gallon made ; this will serve as a damp down, or as a brush finish.

Brown top-pieces may be produced by the simplest hand method by scouring off the grain of the leather and applying a mixture of gum, colouring matter, and oxalic acid. Oxalic acid is commonly used for cleaning and bleaching stitches or leather where a uniform colour is wanted.

Brown top-piece mixture :—Add some finely-ground oxalic acid to a weak solution of rye paste ; this should be sufficiently acid to turn the black surface of ordinary leather a yellow colour in about fifteen seconds ; add to this a few drops of salad oil, to make the mixture work smooth. If the top-piece is attached with iron nails the acid must be much stronger ; the degree must be a matter of experiment.

Methods of using :—Get the top-piece perfectly smooth, spread the mixture on the top-piece with a piece of rag until it polishes. Then wipe a little white fake on it to keep it clean. The fake also improves the polish.

Mixture No. 2 :—One pennyworth of bismark brown dissolved in one pennyworth of methylated spirit, some well-soaked gum dragon and oxalic acid.

Method of using :—Keep the bismark brown in a well-corked bottle, and add it to the gum according to the depth of colour required. Then add a little acid. Put the mixture on the top-piece and polish with a slightly-greased rag. When polished, fake it with white fake.

Mixture No. 1 is also a good mixture for cleaning fronts of heel and coloured stitched welts. To finish coloured stitched welts :—Level the welt in front of stitch with welt trimmer or plough, scour front of stitch thoroughly smooth. Spread a little of No. 1 top-piece mixture on the welt, and sleek it well with a stitch bone, then rub round the welt with a piece of rag to get off surplus paste, and with the prick-stitch make a mark between each of the stitches. This is called pricking-up.

Second time stitch mixture :—Dissolve 1 oz. gum arabic in 2 ozs. of water, put some oxalic acid in the gum water, make it so strong that when a drop is applied to a dirty part of the hand it almost turns it yellow. If allowed to stand for a few days, all suspended matter will have found its way to the bottom, leaving a clear, strong mixture. This must be applied to the welts just before the boots are rubbed up to give the welts a bright and finished appearance. Great care must be taken in using this mixture, for if any of it gets on the upper it will turn it red, especially kid, crup, and satin hide. Uppers that have been discoloured in this way, can be brought back to their original colour by applying a strong solution of washing soda to the part affected.

Black stitched welts should be levelled and scoured the same as coloured welts ; and any wax on the stitches may be cleaned off with benzoline. The welt should then be gummed. It is an advantage to sleek in the gum, forming a solid surface ; the stitches should then be pricked-up, and the stitches inked. When dry, they should be brushed up, and a gum solution applied according to the degree of brightness required in the welt. If the stitches are required dull, they should be left as brushed. A medium polish is produced by applying gum water ; a very high polish by shellac gum mixture. This is made by dissolving 1 oz. of shellac in 4 ozs. of methylated spirit, and adding an equal quantity of gum solution. A coat of this gives a very high polish.

The hand-finisher's usual bottom wash is made of bottom balls, Epsom salts, soap, gum solution, and methylated spirit, and a little oxalic acid as a cleaner. The proportions are :—Gum dragon, $\frac{1}{4}$ oz. ; Epsom salts, $\frac{1}{4}$ lb. ; soap (good yellow), $\frac{1}{2}$ oz. ; methylated spirit, 2 ozs. ; oxalic acid, enough to heap on a sixpence. Dissolve gum in the water, then add the others, except the spirit ; boil for ten minutes ; when cold add the spirit. Different colours or tones may be secured by using

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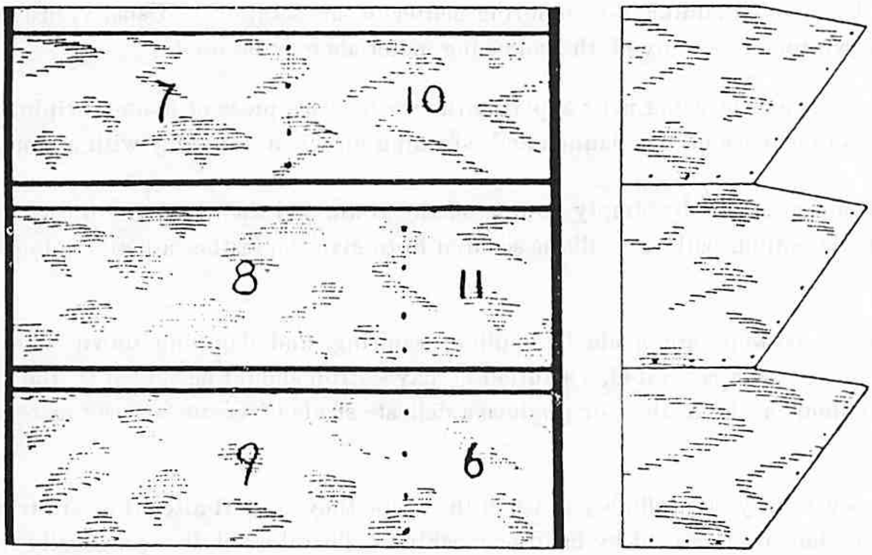
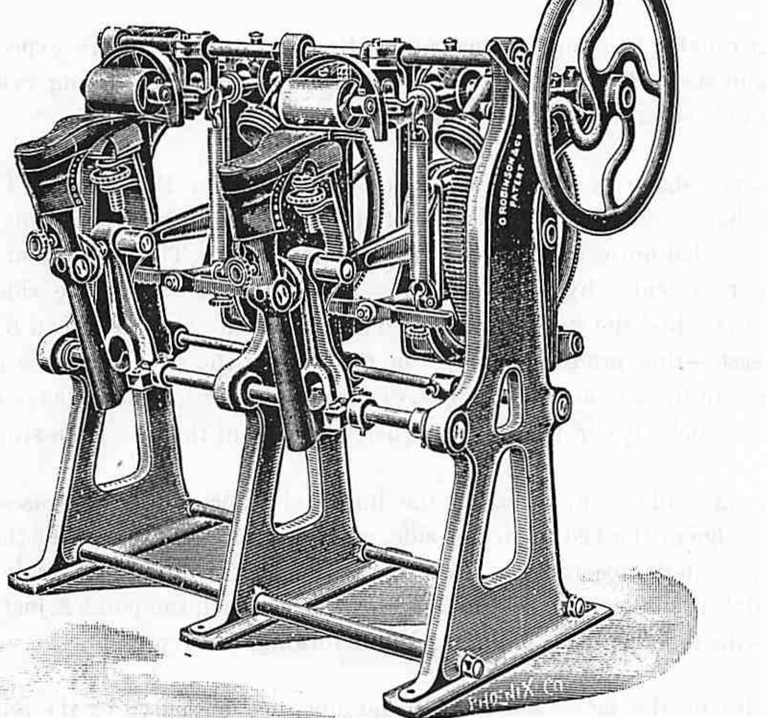
Plate 116.



Front View.

Side View.

Last Cubs for Finishing Room.



"Champion" Bottom Roller, by

Messrs. ROBINSON & Co.

Champion Works,

KETTERING.

(See Plate 112).

coloured bottom balls, or by adding any colouring matter to the solution. Usually, brown annatto is used to give a brown tone; but any of the colouring materials may be used.

The usual methods of using is by applying the wash with a piece of flannel, wiping any surplus liquid off with another piece of dry flannel, and polishing up when quite dry with a bone.

Buff bottoms are made by simply buffing off the grain, and then scouring up with sandpaper; in some cases a little bottom ball, or chalk, is scoured in to give the leather a better colour than it has naturally.

Damp down bottoms are made by buffing, scouring, and damping down with gum water. Where a very delicate shade is wanted, a solution of hay saffron should be added to the gum. This will modify the colour of the leather, or produce a delicate shade of cream according to the amount added.

The edges can only be profitably finished the shape they are left after they are trimmed; this is correct whether they are trimmed by hand or machine. Therefore it is a practically indispensable condition to good finishing that all cutters and setters be made to follow.

It is sometimes considered advisable to make some difference between the size or the shape of the cutters compared to the setting iron that is to follow; it is thought that the setter will make a better edge if the cutter is a little smaller, but it has been found that this is not always correct, owing to the difference in the swell of leather after inking.

The most reliable method is to make all cutters and setters that are expected to follow exactly the same shape and size. The amount which the edge swells after inking is sufficient to make the required tension between the edge and the setting iron.

The relative shape of cutters and setters is shewn on Plate 105. The points by which different special shapes can be described are as follows:—A, is the bed, which may be flat for a square-shaped edge, or rounded outward in the tool for a hollow edge. The amount of rise in the centre of the bed would be represented by a corresponding hollow in the edge. The side of the iron which comes to the welt is called the jigger, or guard side of the iron; the depression B on the side of the bed is the jigger crease,—this produces a wire on the edge of the sole. C, is the jigger wire, making a crease that throws up the stitches on the welt, or forms a depression on the edge of the fudge. D, is the guard or back which lays on the welt, and helps to prevent the iron from slipping out of place.

The opposite side, E F, is called the lip or clearance; in some cases, there is a crease or depression at the edge of the bed upon this side, making a wire on the edge of the sole. This portion may be cut at any angle according to the shape of the edge required; as a rule it is cut at about the angle shewn, which is sufficient to set the edge of the channel, the point E just reaching the edge of the cut which forms the channel. F, is simply the forging, and represents the waste metal.

The angles of the faces and guards and lips, are measured by the relation to a line drawn through the edge of the bed and vertical with the face of the iron, as A B, A B. These lines are supposed to coincide, and the angle is counted to right and left across a supposed quadrant, thus, the angle from the side of A B, would be less than 90 degrees whichever way it was taken.

The different shapes are made up of these angles, wires, and creases, a few of the possible differences being shewn from A to H. A, is a square, plain face that is commonly used upon heavy work ; it makes a very good edge that does not lose shape so quickly as some of the more elaborate shapes ; at the same time, it is one of the most difficult edges to make perfectly true to shape, any imperfection that might be disguised by the ramifications on crease and wire, are quite evident in the square face edge.

B is also suitable for heavy, solid work, the edge, without being dead square, would be considered a square face, it has a jigger wire sufficient to throw up a stitch or fudge, but beyond that is a plain iron. B is a medium hollow-faced iron with two creases that produce two wires, as explained ; it should be mentioned that in the reproduction of these creases, far too much has been taken out, and the crease on the right hand side of figures C and D should be opened out at the top next the face, to admit of the wire on the sole clearing the crease on the iron ; the crease on the left hand side is nearer the shape, but too coarse. Figure D represents a light iron with jigger crease and wire, the crease should be as described and the wire as figure B.

Figure E is a bevel-edge iron ; this produces a light edge on a sole much thicker than the actual stock, and is set to form a crease on the edge of the sole—referred to as a wire on the cutter or setter. F, G and H, are waist irons. F is suitable for a rather heavy substance sole, in which the waist is bevelled straight down to the edge. G and H are the usual round waist irons, G being plain, and H with a wire.

In addition to these, there are many special irons that contain the points mentioned in variations that are suitable to the shape required. Pump irons are made in which the lip and guard meet—without any bed between. This produces a sharp edge on the forepart. Edges are made from this to any substance—these are generally referred to as pump irons, because they are made as a rule for turns, or pumps. Some irons have a wire down the centre of the bed dividing the edge into two ; the two sides of these may be quite different in character ; the guard side may be hollow-faced, with crease and jigger wire ; the lip side may be bevelled off with any combination of wire and crease. These double irons are called clump irons.

The path of motion in setting edges by hand is in the line of the edge of a shoe, and this motion is reproduced in the "Robinson" Edge Setter, Plate 115. This setter, unlike all other machine setters, reciprocates along the surface of the edge, and therefore sets with the identical motion of the hand worker. It is claimed that this motion in the machine does not set up the vibration that appears inseparable from the usual movements of the machine edge setter, and that the clearance provided in the irons allows of a greater stroke each movement than by any other motion.

The path of motion of the edge setting machine is shewn on the centre diagram. It will be seen that the tool moves in the arc of a circle, in which the centre is at C, and that the actual movement is from D to D upon each side. Naturally if the tool was the same width all along the face, there would be a probability of the edge of the face cutting into the edge at each stroke. This is prevented by cutting the sides in a curve from the centre of the face to the four corners E, E, E, E, and is called the clearance. In addition to this, the iron is sloped away from the centre of the bed towards the two edges, producing another clearance as regards the face of the iron. These in combination produce the double curve that is indispensable to a perfect setting iron. If the curve is too

great or carried back towards the centre too far, the iron has not sufficient contact with the leather to burnish or set the fibres. If not curved enough, the workman has too much work to do, and usually puts too much pressure on the iron to produce good work.

Some general remarks respecting the routine work may not be out of place. Lasts should be inserted in all work that reaches the finishing room without them. These lasts should be precisely the same as those the shoes were made on, and they should be kept in racks and cubs so that they can be found immediately. The arrangement shewn on Plate 116 answers very well, and permits of each size and each foot being put in its proper place; more time is lost in finding fellows than in sorting sizes. This method will allow of all sizes of one type being kept together, and may be arranged along wall space, or back to back. Where lasts are already in the shoes and have to be returned to the lasting shop, it would be a good plan to have the goods made quite ready for putting in the cartoons, and having the lasts slipped in the lasting room.

Work racks are of more importance than generally understood; it is a good plan to have the shelves of these racks covered with felt, and divided by narrow strips as shewn upon Plate 120. This prevents, or helps to prevent little accidents, as ink falling on to the linings under a row of work recently inked; or of the bottom of one shoe being brought into contact with the wet edge of another: these small matters go towards preventing any waste of time in cleaning what should not have been soiled.

A close watch should be kept on the working parts of machines; the seat guard of heel parers wear sharp, and if not remedied, are likely to cut the upper. All parts that are supposed to meet, or to protect the top, should be examined at regular intervals, as should all the ordinary parts of the machines. It is bad policy to wait until a machine breaks down before the machine is examined as to defects. This examination of machines should be at stated times, taking so many per week; a very few minutes would be required to see that all was going right.

Although machines have been much improved during late years, there are still several processes that must have a final working by hand. Heel breasting and trimming rarely leaves a sufficiently clean job to permit of the shoe being finished without the burr left by the process being taken off by hand. There is no doubt that it is an advantage to breast before trimming, this clears away the loose stuff not wanted by the heel trimmer, and makes a better job than breasting after.

Edge trimming is an art, and most of the defects are caused by the bad stock fitting still common. For accurate single trimming the stock must be true to shape; if stock was cut and put together precisely true, a great many edges could be trimmed true in one trimming that takes two now. As a rule, good class work requires two trimmings—one wet, one dry.

Edge setting is one of those processes that the hand worker appears to have relinquished to a machine process without good reason; there is still little difference between the speed of the machine setter and what the hand worker could do on good class work. The setting irons must be true to shape, and if there is any difference between waist and forepart, provision must be made in the special waist iron. Square edge waists can very well be set up with the forepart iron, but as a rule special separate irons should be used. If the edge is correctly trimmed, the setter should not attempt to do more than glaze the ink; as a rule he attempts too much, and pushes the edge up much too hard; most machine finishers work harder than they need to.

Edge setters as a rule try to work too hard; it is not necessary to push the edge so tightly towards the setter, the shape should be made by the trimmer and the edge simply burnished by the setter. In connection with this, we have many different opinions respecting the necessity for hand knifing at the corners of the seats and along the waist; no doubt most common work can be left as it comes from the trimmer, and if the edges are trimmed before heeling, it makes a fair job. But the edge trimmer has not arrived that can trim quite to the corner of the seat, and, therefore, the piece left has to be either taken off by hand, or pushed into a lump at the corner. For really good work, the waist and corners require several little points seeing to, the waist must fit the iron, and although special waist cutters are used, shaped as the setters, they do not make the connection between the points so well as it can be done by hand.

The burnish, or pad, and brush finish can be made just as good as the preliminary processes are executed. It is scarcely possible to over-rate the importance of the scouring operations—good work should be scoured three times. As remarked with reference to other matters, most scourers appear to desire to expend too much muscle on the work, the stock should not be pushed to the paper but simply held to. If the leather is over-heated in the scouring, nothing in the after process will remove the defect. The first scouring should be with No. 1½ sandpaper, the second with No. 90 emery, and the third with No. 120 emery, with the first bite taken off, or with worn down paper from the other emery roll.

Bad coloured edges may be prevented by using a wash of sulphate of iron, this may be scoured in, producing a nearly black edge, or may be washed over after scouring. The after processes of machine burnisher, or pad and brush, depend very much upon how these processes have been performed, there is no doubt that the burnish is the best finish, but very good results can be secured by the use of the pad and brush if the preliminary work has been done correctly.

The pads and brushes should be used as the scouring machines--with moderate pressure, if too much pressure is applied to the pads, the quick black is partly destroyed, its power to take a high gloss decreased; many really good finishes are condemned because they have not been worked in a proper manner.

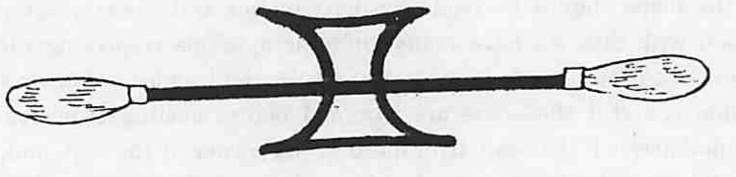
Plate 114 illustrates the original arrangement of a combined finishing plant upon one bench, it is the production of Messrs. Robinson & Co., Kettering, who are he original patentees. The effect of this arrangement is that the many belts used for conveying the power from the main shaft to the different machines are dispensed with, and the work executed by one belt only. This is achieved by arranging a shaft parallel to and in the centre of the frame, this shaft being provided with pulleys for driving the various machines, which are by this arrangement practically one machine.

The dust exhaust is arranged at the rear of the various machines forming the set, carrying all the waste products from the processes clear of the operatives. The shafts and pulleys are protected in all parts of the machine, and are so arranged that any part of the apparatus can be started, run, and stopped, independently of the other machines. In fact, this machine—although regarded as one—is really practically a combination of all the usual set of finishing machines consolidated into one machine by this special arrangement.

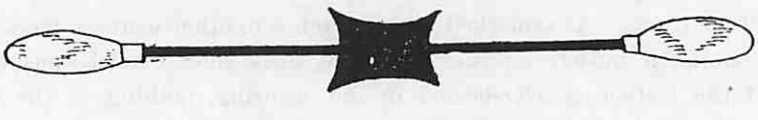
Various combinations of these arrangements are made to suit the requirements of the different classes of manufacture, for instance, a set may include all the apparatus required for finishing in a

To face Page 220.

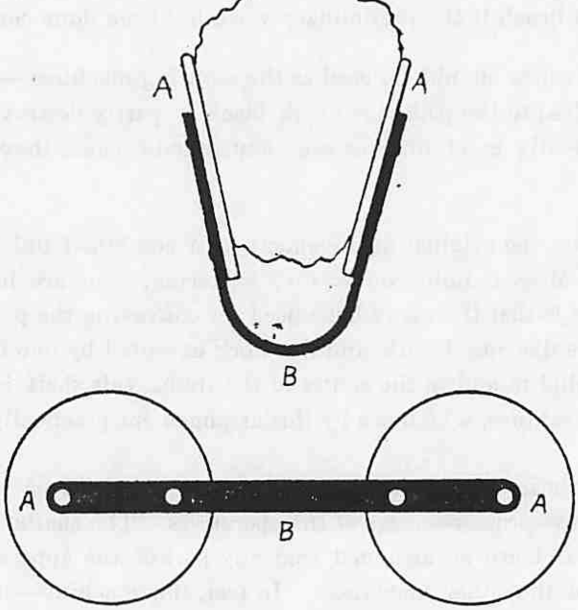
Plate 117.



Sleeking Iron for Uppers.



Sleeking Iron for Uppers.



Sponge Holders for Dressings.

Apparatus for Dressing Shoes.

large shop, or may be specially modified to the needs of smaller outputs. This special requirement should have careful consideration ; sets that are quite the ideal arrangement for certain outputs would be impracticable for those greatly different. The producer of about 1,000 pairs per week might very well be suited by a single set of machines upon this style of bench ; the repairer would require a much smaller set, in most cases without the edge setter, in fact, would finish by pad and brush. These classes of bench finishing machines are produced by Messrs. Robinson, and are simply modifications illustrative of that described above.

The routine of a machine finishing room must be controlled by the foreman in charge (see management), it is advisable that the usual work ticket be supplemented by a special department ticket, so that the foreman may group the different orders into numbers of pairs that are convenient for apportioning to each operative.

The cost of the room should be ascertained in precisely the same manner as all other departments, by a system of checking each item used by the department and of all work executed. It may be advisable for the sundries to be costed quite separately, that is, that no average cost be accepted. Where some materials are made in the department, and some purchased, it frequently happens in small shops that a correct account of the actual cost of every detail is not kept, and sundries are made in the department that might be purchased from dealers at a less total cost. (See management).

The Combination Heel and Forepart Parer—(Plate 115)—is another example of the combined machine. It consists of a double arrangement of cutters that can be brought into position by means of the patent revolving head, one cutter being quite out of the way while the other is in operation. This arrangement is a great advantage where the capacity required is not large and there is not sufficient work for separate operators on these processes. All these combinations of separate machines for each process, to one machine for all, are provisions for the greatly varied requirements of manufacture that may be limited to a few hundreds per week, or may be extended to many thousands—according to the size of the firm.

CHAPTER XIII.

Treeing, Pressing, and Packing Department.

THIS Department has developed from the crudest methods of packing shoes in barrels to one of the most precise and particular departments in the factory. The actual inspection of the goods as to correctness of make and number, according to the order, may be carried out in this department ; or it may be a separate preliminary matter that is under the control of a goods inspector.

This goods inspection must be thorough ; it should be under the control of some duly qualified person ; and although thorough, be just ; and should be of such a character that no further criticism would be accepted. The inspection must include correctness of number, of description, and for the quality of the goods according to the standard the goods represent.

A special log should be used for this room, with space for the details, as set out in management. After passing from the inspection, the department would be responsible for all damage afterwards discovered ; under the present method of dressing there is almost as much liability to damage in this department as in any other.

The method of dressing goods will depend upon their nature and the condition in which they arrive in the room. In some cases glace work requires ironing with a hot iron in addition to dressing : in others it is considered sufficient if the work is thoroughly cleaned. In any case, the first preparation is to remove the ink and dirt that is on the goods. This is usually done by simply sponging off with, more or less, clean water. The best method is to first wash off with water, and to then brush up on the brushes with which all dressing rooms should be fitted. (See Plate 116.)

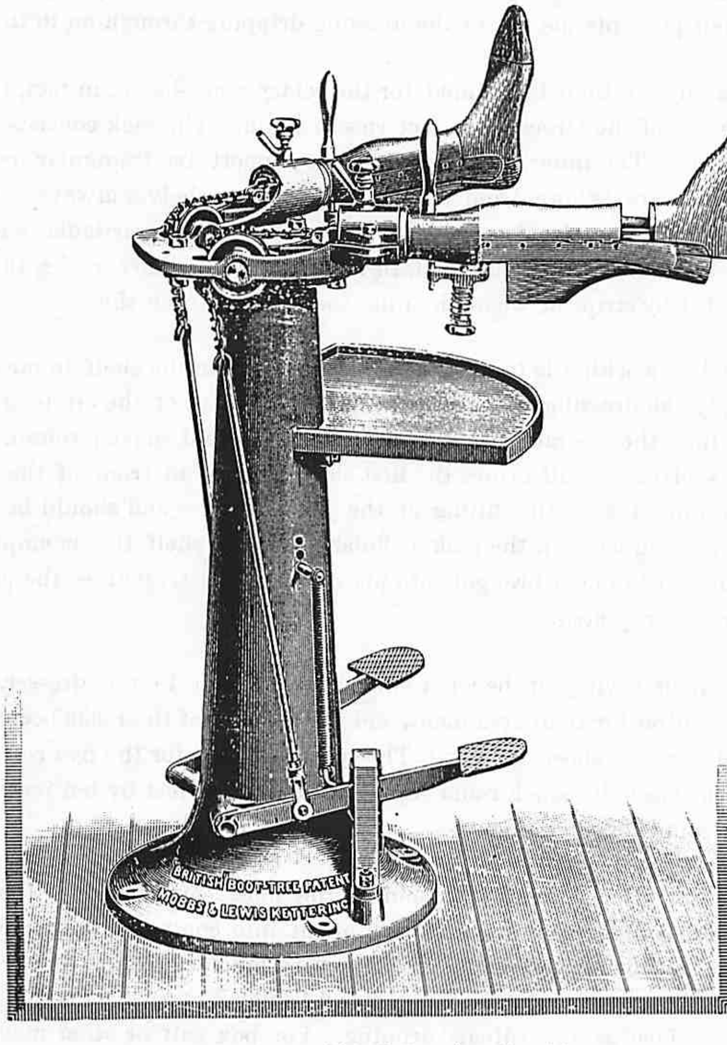
This brushing is not used to the extent that it should be ; it lays down the face of the leather and makes a surface that is better than by any other means, and is much safer than the hot iron. The brushes, as shewn, should be of different shapes : about four inches, two inches, one inch, and twin cones.

These brushes will serve for the special purposes that they are shaped for. The broad brush will remove all dust from the stitches and the welts ; the narrower brushes will be found useful for brushing the parts that are not easily got at. All coloured work is finished on these brushes ; however, the bristles should be long and soft, and the shoe should be brushed and dressed the same way.

The use of the brushes has another advantage, it allows of the brushing up of the edges which are often dulled by the running of some of the water used in the cleaning of the uppers. The usual remedy for the damping of the edges is to rub them up with selvette, but there is no doubt that the brush would secure better results.

Plate 120 illustrates some of the special appliances used in some American factories. It has been found that work has either to be dressed upon the racks or placed upon benches. If the work

Boot and Shoe Fillers.



"The British" Treeing Machine.

Treeing Machines and Shoe Fillers, by

Messrs. MOBBS & LEWIS,

Carrington Works, KETTERING.

is first placed upon benches there is a loss of time, and the bottoms are sometimes marred by the shoes being put upon a place where some of the dressing has run from the work. There is also a liability for the shoe to be touched while still wet by the bottom of the shoe being placed at its side, and the work more or less spoiled. If the work is placed upon racks, there is a liability for the dressing or the ink in the finishing room to run and drip through the rack on to the lining of the shoe below.

All these little troubles are removed by covering each rack with a strip of felt, and nailing a narrow strip of wood at the intervals that each shoe is supposed to occupy. This defines the space allotted to each shoe, and instead of the work being placed down haphazard, each shoe is put in its own space. The felt prevents the ink or the dressing dripping through on to the shoe below.

A great saving of time is claimed for the rotary rack shewn, in fact, these racks are used in great numbers in some of the largest shoe factories in Lynn. The rack consists of circular wood ends mounted on standards. The inner sides of these ends support five triangular iron supports to shelves. Each of the triangles are swung from an angle so that the shelves always swing in position. This arrangement permits of the circular ends being turned and any particular shelf being brought into position before the worker. As mentioned, in reference to the other racks, the shelves are covered with felt, and divided by strips of wood, defining the place for each shoe.

The method of working is to place a row of shoes on to the shelf immediately in front of the dresser, and to apply the dressing, a slight turn, in fact one-fifth of the circle of the wood ends brings the next shelf before the operator, this is also filled up and moved round. The operation being repeated until the shelves are full brings the first shoes dressed in front of the worker. These shoes will have been standing during the filling of the other shelves and should be about ready for either rubbing up or for putting back on the rack as finished. The shelf that is emptied is then filled with fresh dressed goods and the next brought into place, the goods treated as the previous ones, the shelf refilled and the process repeated.

This is a great saving of bench room and of labour to the dresser, the shoes are always opposite the best position for their treatment, and the rotation of the racks occupies as near as possible the time required for the shoes to dry. The space required for the five rows of shoes is about two feet by four feet, the space in bench room would be about four feet by ten feet. The saving in space alone is worthy of some consideration.

Ironing is sometimes done by machine, the most commonly used being the "Copeland." This consists of a treeing apparatus that is brought into contact with several burnishers, the same being heated by a gas flame and being in shape very much as a hand finisher's heel dummy. The burnishers traverse the upper of the shoe, much as "Tapley" burnishers act on the heel; the effect is to lay down the surface as in ordinary ironing. For box calf or other medium substance to stout leathers that require ironing, it appears to be a very rapid machine, but could scarcely be used for very fine work.

Anything that makes for cleanliness in the final processes of shoe making is to be considered an advantage; one of the minor matters is the holding of the sponges that are used for dressing the shoes. Some dressers use two discs of celluloid with which to grip the sponge; it would probably be

an advantage if these discs were joined by a strip that acted as a mild spring, as shewn on Plate 120. This would permit of the dressing being squeezed out of the sponge without most of the liquid going through the fingers ; in fact, an envelope should be made that would be represented by half an indiarubber ball into which the sponge fitted ; this would allow of the liquid dressing being applied where it is wanted—on the shoe, and not over the fingers, benches, and linings, as is common.

The parts of the uppers that have become wrinkled should be ironed out, or worked over with a presser that conforms to the shape of the part being treated. These irons are made in various shapes, and generally of metal ; although some treers make their own, or modify others, out of box-wood shapes. Some of these are shewn in the diagrams on Plate 120. They are made single or double, much as hand-finisher's kit.

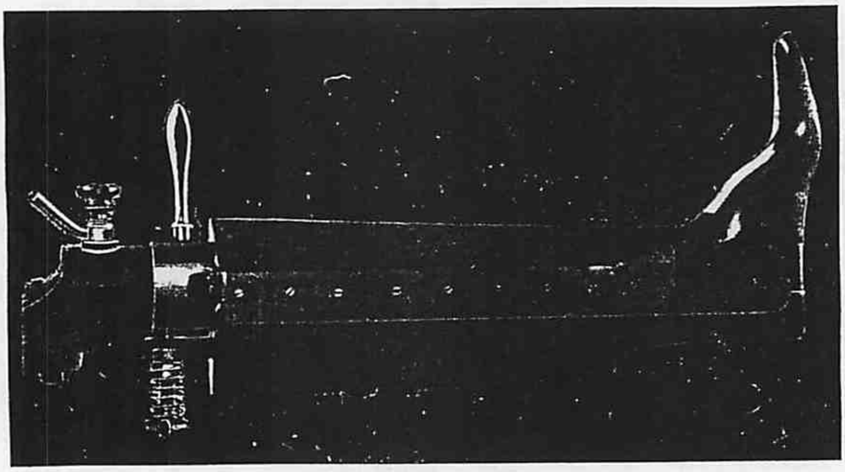
These irons must be used with discretion ; it is not sufficient that the iron be rubbed over the upper in any direction, as some finishers appear to think ; the direction of the travel of the iron must be along the direction in which the leather is tight. It is possible to iron a shoe looser than before, if the direction of the ironing is the way the leather is loose.

If the leather is fairly solid the first attempt to remove a crease may be along the ridge of the crease—not across it. Having laid the crease down, the mark can be removed by running the iron across.

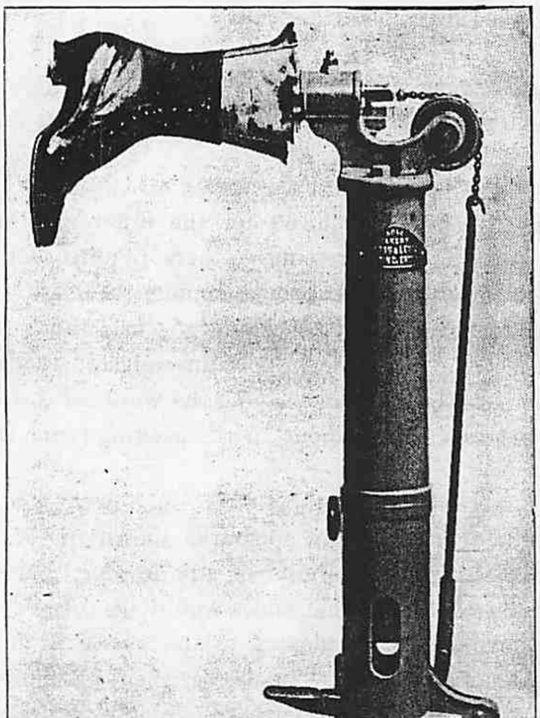
There is an immense difference between the treatment required for the different classes of work. Some classes require nothing more than cleaning and dressing ; others require thoroughly wetting and treeing-up for several hours. There is no doubt that shoes kept on the last through all the processes of manufacture reach the packing room in far better condition than those that are worked through the factory without support ; in fact, this matter should be investigated thoroughly. It has become a question whether the extra cost of lasts required for keeping the work on the last for a longer period than usual would not be repaid by the saving of labour in the packing room, and the better condition of the goods.

Ladies' work, that requires treeing, should be treated on the apparatus shewn on Plate 119. This consist of an upper shaper, which trees out the upper, permits of any ironing that may be required, and assists in the cleaning. It does not always follow that shoes would be dressed on the tree. When a sytem is arranged in the room the details must be adapted to the needs of the work. In some cases the treer would simply tree on, clean, and take off. The dresser should then apply the dressing. There is no doubt that the use of fillers for dressing has not been exploited as it should be.

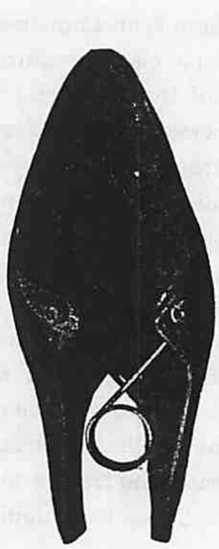
The actual machine used is of little consequence if the principle of filling out the boot is obtained, but if there are extreme shapes used, such as spike toes, fall backs, or the new American shapes, it is advisable to get trees to fit these shapes ; if this is not done the two sets of shapes that usually go with the machine would have the opposite effect desired. The best way of any is to get a set of trees made for every set of lasts used in the manufacture of the boots to be treed. It is also important that the treer should have proper tools ; this reduces the labour required, and makes it easier to bring out a fine, smooth upper. The tools required are—1st, what is called a long stitch, or sleeker, and should be of hard fine wood, such as ebony ; this is suitable where there are no hooks or eyelets, as these will cut it up, leaving the upper rough instead of smooth. 2nd, a similar sleeker, but of metal



Long Boot Tree.



Upper Shaper, for Cleaning and Ironing Ladies' Boots.



Short Filler

Treeing Machines and Shoe Filler, by

Messrs. MOBBS & LEWIS,

Carrington Works, KETTERING.

that can be heated, for smoothing kid legs or uppers, if required ; this sleeker is best to use where there are hooks and eyelets to go over, and you can get closer to welts and curves.

The method of applying the materials and sleeking for a boot should be as follows :— The boot is pulled on the tree, the legs are fastened with a wire attachment over the hooks ; this prevents wrinkles on the vamps in sleeking. You next press a treadle down with the foot, this acts on a strong lever in the horn or leg of the machine for the purpose of forcing the heel portion of the horn or backs down, and driving toe of lasts up, so filling out the boot at all parts ; very great care should be taken that too much pressure is not used, or the leather will open and require more time and labour to fetch it to its normal appearance again.

Ironing the uppers is only a temporary remedy and is liable to take the life and wearing qualities out of the stock, dull the gloss, and, in the hands of an inexperienced workman, the boot may be spoiled ; if the iron is too hot, or the operator bears too hard, it burns the upper, causing it to curl up ; the wrinkles are best worked out by hand where it is possible.

Where ironing is indispensable to secure the desired result, it should be in the following manner :—A hollow metal box, with a burner inside for heating, and with a rubber tube for fixing on an ordinary gas burner is used, this is passed over the legs or upper, which has for the purpose passed over it with a sponge. Some of the coarsest stock and the ugliest wrinkles can be got out in this way with care.

Where ironing-up is not indispensable, and a support is wanted for the shoe during its preparation for packing, the use of fillers would be most economical in point of convenience and cost.

The basis of the dressings used for bright finishes is, as in bottom finishes, gum murcilage, and the intensity of the polish is in proportion to the amount of shellac used in the solution. Where a very cheap polish is required and gum is considered too expensive, a solution of sugar or treacle is sometimes made up, but for ordinary purposes gum murcilage may be considered the base of the dressings.

Gum mucilage may be made by simply soaking a half-pound of gum dragon (gum tragacanth) in two gallons of water for about three or four weeks, until it is all dissolved. If the gum is used in the form of powder it will dissolve much sooner, and more completely, in either case the mucilage must be strained or the undissolved gum taken out. The gum will dissolve much quicker if one ounce of oxalic acid is added to the water, but this should not be attempted if the mucilage is to be used with any oils. The colouring matter is as for bottom finishing, aniline dyes and the usual stains and vegetable dyes, and are applied in the same manner.

Where shellac is used to give a high gloss, some matter is added to reduce the brittleness. Camphor, boiled linseed oil, and castor oil are all used for this purpose, singly or in combination.

Generally, the mucilage with some coloring matter to give the desired tone should be sufficient for new shoes. Some makers add a solution of indiarubber for the purpose of producing a waterproof dressing and an elastic surface.

Where a dull gloss is required some solution of soap or wax is used, and the colouring matter is usually lamp-black or bone-black. All these are used in all kinds of combinations, and some of the special mixtures are considered a secret. At one time the usual dressing was made by simply boiling the calf kid cuttings from the clicking shop ; a little soap and ink added to this made the dressing.

Dubbins are solutions of resin, beeswax, and colouring matter (lampblack and Prussian blue) in turpentine ; they are used for greasy leathers of the heaviest kind.

Brown dressings are either simply mucilage, or compounds of wax or soap, and wax in turpentine or petroleum ; colouring matter is added to this to produce the desired shade. This colouring matter may be of any of the materials used in the finishing room.

A few simple recipes may be useful as a basis for the production of special dressings to suit particular purposes :—

Liquid Dressing for Glace and Box.—1 quart of gum mucilage, 1 gill of vinegar, 1 lb. of bone black, $\frac{1}{4}$ oz. indiarubber shreds dissolved in 1 gill of hot olive oil, 5 ozs. sulphuric acid. Dissolve the bone black in the acid by stirring in, and leaving for several hours ; then add the vinegar and gum solution ; add the indiarubber and the hot oil to the others. This should be applied with a sponge. One quart of mucilage added to a solution of 1 oz. of shellac in 4 ozs. of methylated spirit ; add to this $\frac{1}{8}$ oz. aniline black. This can be applied with a sponge.

Dubbin Dressings for Heavy Leathers.—4 lbs. wax, $\frac{1}{2}$ lb. tallow, mixed into 4 lbs. hot linseed oil, and $\frac{1}{4}$ lb. litharge ; mix up 5 lbs. spirit of turpentine, $\frac{1}{4}$ lb. shellac, and 1 oz. aniline black ; add this to the wax and oil. This makes a waterproof compound for good leathers that are required to have a medium polish.

Dressing for Enamelled and Patent Leathers.—A one per cent. solution of shellac in methylated spirits (1 oz. of shellac to 100 ozs. of spirit), and 5 per cent. of resin are dissolved together ; to this add a solution of aniline black in spirit, to shade required.

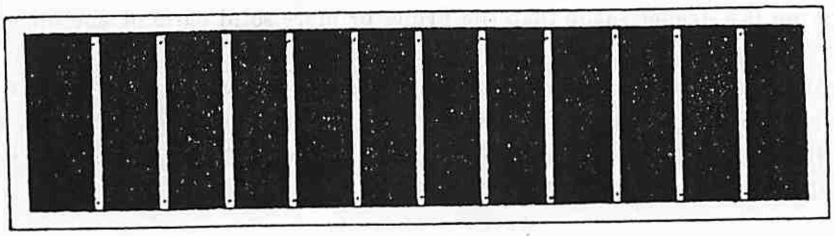
Waterproof Brown Polish, without Colour.—1 lb. spermacetti wax, 2 lbs. paraffin wax, 2 quarts petroleum (paraffin oil) ; mix these together slowly into a paste. Apply by rubbing on the leather and finishing with a rag.

In selecting the composition and dressings you cannot lay down hard and fast rules, as no two persons seem to apply them the same. It has to be found out by experience what is best suited to the class of trade done ; but materials should be selected, where possible, that will suit all classes of work, as too many sorts cause confusion. Usually, in the case of top dressing or size, the same material will do for split work, crup, satin hide, and calf ; another is suitable for box calf and glace ; another for brown work.

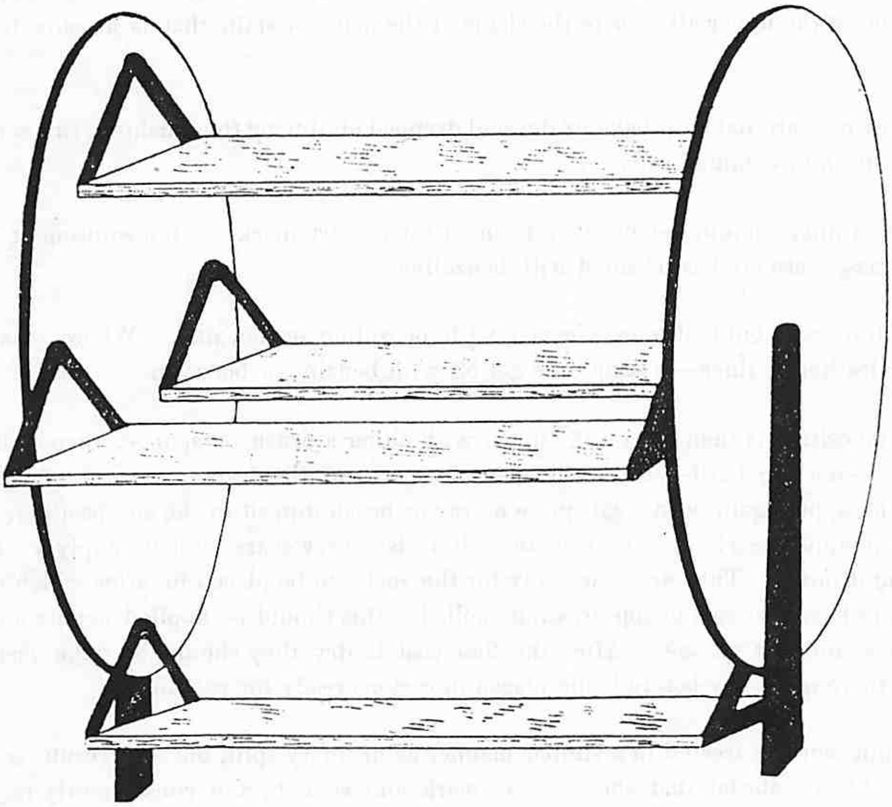
Some practical hints may be of service to those unacquainted with the usual methods of dressing shoes. These are simply the usual methods of the practical dresser in every-day practice.

To face Page 226.

Plate 120.



Work Rack Covers and Dividers.



Rotary Racks for Dressing Goods.

(See Plate 117).

Brown Calf.—First place on the trees, then clean off any dirt or wax with benzine or benzoline, then apply a cream dressing with a soft sponge or flannel ; when nearly dry, polish with a soft clean cloth or a power brush.

Brown Glace and Hide.—These materials, having a face or smooth surface, a liquid dressing can be used which is a polish in itself. If a liquid is used for Russia calf, which is at all loose, it will soak in too much, giving it a deeper shade than the firmer or more solid parts of the upper.

Coloured work is always more or less marked in some operation, and by reason of its being coloured, will show every mark whether it is by the warm hands of the operator, or dirty water stains, and worst of all—oil stains. If it is of a very light colour, it is very difficult to clean, as it is more easy to darken a leather than to make it lighter.

To get sweat marks off, the uppers are sometimes washed with Castile soap and water, if an acid is used, it must be very mild and carefully used. The mildest form of acid is the juice of a lemon, which can be used for a dirty water stain; some use benzoline, but this is liable to affect the colour and would require staining before polishing.

It is very difficult to remove an aniline or copperas stain. If cement gets on the upper, rub it off with a cement ball, if it leaves a stain it can be got out by pulling some green cement from the leveller, mixed with a little French chalk, on the upper, leaving on for 10 to 15 minutes, then rub off with a cement ball. This is also good for an oil stain sometimes. Wax from the sewing or stitching machine can be easily got off with a little benzine. In the ordinary way I should recommend staining the upper all over to the shade of the mark or stain that is already fixed on the upper.

Black leathers are liable to have oxalic acid dropped on during the finishing, this can be got out with a weak solution of common soda.

Leather linings should be cleaned from ordinary dirt marks with a solution of oxalic acid, except in Smyrnas, these are best cleaned with benzoline.

Linen linings should also be cleaned with benzoline or benzine. Where wax is on the linings—either leather or linen—it should be got off with benzine or benzoline.

The composition is then put on the upper with either a brush or sponge, then rubbed gently with the sleeker—not too hard—or it will open the pores of the leather instead of closing them. Then go over the upper again with a soft piece of rag or brush dipped in the composition, and rub off so as to leave the upper nearly dry and smooth. If it is a very coarse upper, apply a little French chalk in wiping it down. They are now ready for the socks to be placed in, after which they should be dry enough to have one coat of top dressing applied ; this should be applied evenly and smoothly with a fine, close, and soft sponge. After the first coat is dry they should be gone over again, and allowed to get thoroughly dry before being placed in cartons ready for packing.

Calf split work is treated in a similar manner as ordinary split, but the result is not always satisfactory, as it is a material that shows every mark and scratch, and consequently requires more

care in treeing. There is also a tendency in this material to have a grey appearance when dressed ; this can be remedied by going over them again with ordinary grease, then again dress them in the usual way.

Crup work does not require so much labour in treeing. They should be sleeked only sufficient to get any marks out they may have received during manufacture, then wiped down with a soft rag dipped in the composition.

Satin Hide.—This material should have all marks rubbed out with a small bone before any composition is placed upon it, then wiped down in the usual way.

Calf.—This should have Russian fat or grease rubbed in with a brush or the hand, then boned or sleeked up, not rubbed down with any composition whatever if the ordinary treeing composition is used for calf work. The face will break up after the top dressing has been applied, giving it a rough instead of smooth appearance.

Box calf should be put on the trees and all dirt cleaned off with a damp rag, or can be brushed off with a power brush. Afterwards, apply only one coat of liquid dressing ; no cream dressing should be applied unless they can be polished afterwards with a power brush, as cream dressings fill up the cracks in the uppers and cannot be got out again except by brushing.

Calf Patent, when on the trees, wash with warm water with a little Castile soap, not too much soap, or it will have a smoky appearance ; then put on some naphtha, and polish with a soft cloth ; some clean on deersucker, or cloth brush. If there is any wax on the upper it should be rubbed off with a bit of felt.

There is no doubt that the goods should be dried in about the same temperature as the climate that they are being sent to, and that merely raising the temperature is not sufficient ; the means of drying must be by passing dry, warm air through the department that forms the drying room. In some cases the goods are simply submitted to a high temperature and considerable humidity ; the consequence is that the goods are more or less heated but not dried.

It is the usual custom to pack each pair in a card box, or carton ; this is supplemented by each shoe being separately wrapped in a paper, or by a slip of paper being placed between the two shoes in the box. Where the goods are of a greasy nature it is advisable to insert grease-proof paper between them. In some cases, as in the packing of children's work, several pairs may be placed in one carton ; it would be some advantage if these small goods were in card cases of one or two dozen pairs, with the size or sizes stamped outside the case. This would permit of the delivery of cases of mixed sizes and of large quantities.

The number of pairs packed in one case depends on the class of trade and the district they are to be delivered in. A case may be considered to be represented by 24 pairs ; indeed, that is the usual number of pairs in a case in America, and the wood cases are made in large quantities to carry that number.

There appears to be no standard size for the trade in general, but the most common dimensions for the home and South African trade provide for from two to six dozen pairs. The limit is

fixed by convenience in the case of the home trade, and by the method of calculating charge for carriage for shipping. This charge is fixed by the weight of the package in the case of the home market, and by the space occupied in the case of shipping. There is, however, a limit to the weight also for foreign trade ; this limit varies with the different lines, but usually 500 lbs. is the limit of weight.

To meet this condition, cases are made with an inside measurement that will take 72 pairs, which would be well inside the weight limit.

The size of the card boxes, or cartons, should be just sufficient to take the shoes without crumpling, and yet not allow of their shaking about. There are some differences made in this matter ; some manufacturers prefer to lay the boot sideways in the carton, with the bottoms towards the side, and the legs overlapping. This is probably the best method for the home trade, but occupies too much room for the foreign trade, and is too loose. As a rule, cartons for the export trade are made about one inch narrower, and a half inch shallower, than for the home trade. Card boxes are made for long work and for leggings, and in all sizes of children's.

Messrs. Birdsall, of Northampton, in answer to an inquiry respecting standard sizes for cartons, say :—

There is a great variety in sizes, every manufacturer requiring his own particular measurements, and, consequently, it is difficult to specify any standard sizes.

The export sizes are naturally pinched as much as possible to reduce freight, and very accurate measurements are necessary if the packing cases are to be filled with cartons to the best advantage. In many instances the manufacturer hands over a carton to the packing-case maker with instructions to make a case to hold a given quantity. Most measurements are taken inside the carton, but with shipping orders they are frequently taken outside over the lid. The list herewith may be said to represent a fair average of sizes.

In the past few years there has been a general tendency to increase the substance and strength of cartons, but at the same time, the quality and finish of the work is frequently ignored. It is a matter of detail which in many instances does not receive the attention it deserves. A well-made boot should surely be offered in a well-made and well-finished covering, it being highly desirable that the first impression of a client should not be spoilt by a poverty-stricken carton. This, however, is possible if the manufacturer is content with the cheapest carton obtainable, which may be all smashed by the time it reaches the retailer, and the boots consequently lose their finish.

In colours, there is an endless variety, although lately white cartons, which never look out of place, seem to have come more into favour, especially for home trade, for shops in London and other large centres, where little daylight is seen. They are also largely used for certain export markets.

Many of the labels used are really works of art, illustrations of boots, trade marks, and brands being introduced in a variety of ways ; whilst on the other hand, some are miserably poor and ineffective.

Some houses have their boxes covered in specially-designed papers, which display their trade mark, or other easily recognisable device all over the box. In some quarters brown leatherboard boxes, with metal-edged corners, are used, and form a very strong box. Folding boxes are not regarded with favour. Although taking less room when empty, they are inconvenient to the retailer, who desires facility for examining the contents.

HOME TRADE :—

Gent.'s Bal.	... $12 \times 7\frac{1}{2} \times 4\frac{1}{4}$	Ladies' Shoe	... $10\frac{1}{2} \times 5 \times 3\frac{3}{8}$
,, ,,	... $11\frac{7}{8} \times 7 \times 4$	Youths' Boot	... $11 \times 6\frac{3}{4} \times 4$
,, Shoe	... $12 \times 5\frac{1}{4} \times 4$	,, Shoe	... $11 \times 5\frac{1}{4} \times 3\frac{3}{4}$
Ladies' Boot	... $11 \times 9 \times 3\frac{1}{2}$	Children's Boot	... $9\frac{1}{4} \times 6 \times 3$
,, ,,	... $11 \times 6\frac{1}{2} \times 3\frac{1}{2}$	,, Shoe	... $9\frac{1}{4} \times 5 \times 3$

EXPORT :—

Gent.'s Bal.	... $12 \times 6\frac{1}{4} \times 4$	Youths' Boot	... $11 \times 5\frac{1}{2} \times 3\frac{1}{2}$
,, Shoe	... $12 \times 5\frac{1}{4} \times 4$	,, Shoe	... $11 \times 5 \times 3\frac{1}{2}$
Ladies' Boot	... $10\frac{1}{2} \times 5\frac{1}{2} \times 3\frac{1}{4}$	Children's Boot	... $9\frac{1}{4} \times 4\frac{1}{2} \times 3$
,, Shoe	... $10\frac{1}{2} \times 4\frac{3}{4} \times 3\frac{1}{4}$	,, ,,	... $9\frac{1}{4} \times 4 \times 3$

JOCKEY BOXES :—

Men's ...	... $20 \times 12\frac{1}{2} \times 4\frac{1}{2}$	Ladies' ...	... $19 \times 11 \times 3\frac{1}{4}$

LEGGINGS :—

$13\frac{1}{2} \times 4 \times 3\frac{1}{2}$

$14\frac{1}{2} \times 4 \times 3\frac{1}{2}$

CHAPTER XIV.

Management and Prime Costing.

THE present system of factory management, as applied to shoe manufacture, may be safely considered to have come into general use about 1895 ; before that time supervision was not very rigid, the accounts were very loosely kept, and most of the data upon which prices were based were mere matters of memory or opinion ; the higher margin of profit common at that time no longer exists, and therefore more exact methods of supervision and of keeping accounts have been adopted. The systems now in use in an up-to-date factory are so intricate that they would take a volume of considerable size to fully explain.

Even the initial operation of selecting the most suitable shape of building opens up a wide field for discussion : there being grave differences of opinion as to the relative advantages of the one floor (mis-named the American style) compared to a building with three or more stories.

The usual American factory has a basement and two or three floors. This permits the office being in the centre of the building; the bottom stock being on the basement, away from the light ; and the other departments arranged in the order of greatest convenience. The connection between the departments is made by lifts, and the usual staircases. The upper floors have emergency stairways for use in case of fire.

The one floor system obviates the use of lifts but, except where ground is very cheap, is expensive in the space covered, and is not so compact, or so closely in touch with the administrative departments as the arrangement of several floors. There are also some minor objections on the ground of distribution of dust and noise. Upon the other side, the light is unquestionably better for some departments, and the risk of fire certainly less.

Seeing that lifts and wheeled racks permit of the materials being moved between departments quite easily, the shape and lighting of each room becomes of more importance than the manner of grouping them in a building. As explained before, bottom stock in storage should be kept away from long exposure to the sun ; the other departments require a good light, but it is doubtful whether a direct top light is best ; provided that a side light is good, and at the correct angle, there is little to complain of.

There must be sufficient space for the work to be distributed without inconvenience, and in the making and finishing rooms there should be space for spare racks, and for work laid away to mellow. Generally speaking, oblong departments appear to be most adapted for shoe manufacture. These should be arranged in sequence with order of the processes, or connected by special lifts.

Where the multiple floor system is used there should be a lift that connects the bottom stock department with the laster's room, and the latter to the finishing department, and on to the dressing

and packing rooms, quite independent of the connection between the upper stock cutting and the stitching rooms.

If the stores department was in the basement this would permit supplies being passed by the special lifts to either the bottoming rooms, or to the upper cutting and stitching rooms, by their own lifts. On the one floor system it is advisable that the stores should be close to each of the great material-using departments—the bottom and the upper stock cutting rooms.

The selection of machinery must be based upon the probable output and the class of work. It should be a fundamental principle that each machine used be the most efficient of its class, and that it be worked at its utmost capacity. The balance of the plant will, therefore, be decided by the output of the one machine that has the greatest capacity (all other machines being, in this sense, subsidiary); and although this is not generally acted upon, it is a sound principle.

It is also a truism that 'one man one process' produces the best results in factory organisation, and that this carried into effect in combination with the principle laid down as to machines, is the most economical in point of cost of labour.

This has a close connection with the type of machine used and the method of payment. Machines purchased for cash represent so much capital, and are charged with interest and depreciation, whether at work or not. If not fully at work, the proportionate charge per pair for cost, outside labour and materials, is greater than when the machine is fully productive.

From the business point of view, it may be assumed that a machine that equals hand work in quality and speed is preferable to hand labour, because it is independent of the uncertainty of hand labour, and all machines are progressively improved. In comparing the relative cost of hand and machine work care must be taken to include the charges mentioned; a machine process to be equal to hand work in point of economy must cost less for the combined labour and materials; a charge has to be made for depreciation and interest on capital, and the machine cannot be discharged if there is no demand for the work it produces.

There is no doubt that all buildings, machinery, and plant should be depreciated at regular intervals; the amount and the periods must vary with the matter to be considered. Usually, machines are depreciated ten per cent. per year, allowing for that period of value. This appears to have been about correct; but it is doubtful whether it will hold in the future. The number of manufacturers of small quantities who use much low class hand labour is decreasing, and the market for second-hand machines decreasing in scope; and seeing that there is a rapid alteration in the style of machine in use, a higher rate of depreciation would be advisable in the future.

The selection of machines also opens up another matter; that is, that certain types of machines are adapted to follow, and that the purchase of isolated pieces of apparatus that execute operations in such a manner that no other machine can carry out the succeeding process, without preliminary hand work, is not good judgment. The manner in which the machine leaves the work after its operation is only second in importance to the way in which it performs the operation it is constructed to do. In some cases the saving in cost of process by an extra speedy machine is more than lost in the cost of the extra labour imposed on the following operation.

The purchase of material introduces the consideration of the question of the prime cost and the cost of production. These, although closely connected, are quite distinct. Prime cost is the estimated probable cost of the manufactured article upon which the selling price is based. Cost of production is the actual cost of the goods compiled from the accounts. These may be the same, or may shew a profit or a loss, according to whether the materials have been purchased as cheaply as expected, or the relative cost of the labour. Prime cost must be based on an estimate of the probable power to purchase materials, and ability to secure the labour at a certain cost. Therefore, materials have a definite value in the production of quantities of a certain line; this value being defined by the amount estimated in the prime cost. It therefore follows that the purchasing department should be distinct, and that materials should be entered into consumption at the rate provided for in the prime costing. This will entail the keeping of a profit and loss account for purchases, but will prevent the fluctuations in the profit on manufacture caused by variations in the cost of materials, and which is nothing to do with manufacture pure and simple.

Labour is at all times a difficult subject, but it has clearly defined conditions that cannot be artificially altered for any long period ; it stands in precisely the same position as all other commodities. Its cost has a direct relation to the demand for it, and no man of business can be expected to pay more for it than its current price in any particular district. The method of employing labour is also analagous to the purchase of material ; it may be purchased in small quantities : as in piece work, or by contract ; as in day or week work ; or in combinations of both. But both materials and labour are commodities in the hands of the manufacturer, and it appears absurd to praise ability to purchase one commodity, and to discredit the same ability when applied to securing another commodity. The question of piece work and day work is very complicated, but workers on guaranteed wages must shew a profit on their labour, as a return for the guarantee and to provide against fluctuations in their output. The particular method of employment is a matter for the individuals, and outside the scope of this work.

The cost of rent, power, light, and supervision should be charged *pro ratio* to each department, and, if possible, to each distinct group in that department : in proportion to the amount of floor space covered, machinery in motion, artificial light, and special and general management that is used.

The selling price is quite distinct from the prime cost, although it should include the cost of production, incidental expenses, cost of distribution, and some profit. The source of profit is too abstruse to be fully considered here. There may be no profit on the estimate of prime cost, but considerable profit on the purchase of material, the difference between prime cost and the cost of production, or in the discounts and economies in distribution. In small businesses these are commonly considered together ; in large concerns they certainly should be quite distinct.

The method of keeping books does not vary from any other business, but it may be stated that a debit and credit account should be opened for every department and its subdivision, which would include every parcel of goods, machine, and individual in the business.

The ideal method would be some system by means of which any wastage or loss would be immediately detected by the mere system of accounts. But it appears that no system in use is so prompt or effective as an intelligent foreman, and although a system should be used that would test any statement made, and would ultimately detect any defect, immediate notification should be expected from the person in charge of the department.

The general principle of the management is precisely the same as for all other manufacturing businesses, and does not call for any special description here. But the question of the prime cost is so closely connected with the cost of production, upon which it is based, that some examples may be an advantage.

Departments could be designated by letters, as :—Stores, A ; Upper Stock Cutting, B ; Stitching, C ; Rough Stock Cutting, D ; Bottoming, E ; Finishing, F ; Dressing, G ; Packing, H. Individuals would be recognised by numbers. It is sometimes an advantage to group certain numbers in definite departments, or to have separate time boards.

Complete accounts would be kept for the departments, which would not vary in the method of keeping from other accounts, and these accounts would have as debits the cost of labour, and all materials and charges to them ; the credits would be the value of the work executed, as the estimate for prime cost. If there was a continuous large profit it might be assumed that the prime cost had been placed too high.

Stores should only be given out on presentation of a stores request form. This may be as the example, or in any style convenient for entry. The stores number would be entered for reference, and the foreman's receipt would be an acknowledgment of the delivery in the department.

STORE'S REQUEST FORM. No. 127.

Date.	Department.	Received by
October 29th ...	F.	John Wilson.
Amount Required.	**Description.**	**Amount in Hand.**
5 gallons.	x 12 Edge Ink 247	1 gallon.

All materials would have a folio number, and the accounts would be kept by one of the methods explained on Pages 95 to 98, and 148 to 151. Other classes of stores could be kept as the specimen of Folio 247. This represents a purchase of 50 gallons of ink, and the consumption of part

of it; this ruling can also be made to shew the amount in stock at the time of the request for a fresh supply to the finishing department. By comparing the number of shoes finished in this section during the time the ink was in use, the cost per dozen could be ascertained. These items could be shewn in different ways, but the result in any case would be to form a debit and credit account with both the quantity of stores and the finishing room.

In this example there is a supply of 5 gallons on October 29th, which was the first taken from that lot; on November 15th there was 1 gallon in the finishing room, and a request for a further supply. Evidently, 4 gallons had been used, and 46 gallons were in stock; and the product from these could be entered in the product column. This would check the consumption of the material, and act as a check on the consumption of stores in the department.

Folio.	*Purchased from*	Date.
247.	MESSRS. CLARK & ROGERS—	October 26th, 1905.
	50 Gallons X 12 Edge Ink @ 5/-	£12 10 0

Credit to Stores.										
Date.	Request No.	Depart-ment.	Quantity.	In Stock.	Department.	Quantity.	@	£	s.	d.
Oct. 29th.	127	F	5 gallons							
Nov. 15th	184	F	5 gallons	1 gallon						

Received by Department F	...	10 gallons	Purchased	... ...	50 gallons
In Stock in ,, F	...	1 gallon	Used	... ...	9 ,,
Used	...	9 gallons	In Stock	... ...	41 gallons

The efficient recording of the time that the operative is at work is an indispensable part of the office routine. This may be effected in a variety of ways, the example being only one of many methods. It is assumed that each operative is recognised by a number in addition to his name. A time board is placed at the entrance of the factory, which has the series of numbers painted on it in rotation, and hooks over each number; perforated metal discs, marked with the same numbers, are hung upon the hooks which are over the corresponding numbers. The operative takes the disc off the

hook on going into the factory, and places it in a box at the entrance on going out ; the time that he has it in his possession represents the period that he claims wages for. The timekeeper may take the record of those not present, and then credit the remainder.

This may be done by a horizontal stroke for absent, and a vertical one for present. Where there is an allowance of a half-hour for the attendance of those too late for the commencing time, a combination mark may be made ; the man is absent at the opening, but present after the half-hour ; thus losing a half-hour's time. If he leaves off at a quite unusual time, it would be recorded by a special mark, stating the time at which he left off. The total made each week, and the total lost, would be placed at the end of each row of figures.

The Illustration Register will help to explain this :—Operative No. 346 was late on Monday morning, but came in at the half-hour ; he was late again on Wednesday, and Friday, and Saturday ; he made 54 hours and lost 2 hours. No. 347 made a full week. 348 was late on Monday and Tuesday

LABOUR REGISTER.

No.	Monday.		Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Total. Made.	Lost.
346	—|	|	|	|	—|	|	|	|	—|	|	—|	|	54	2
347	|	|	|	—	|	|	|	|	|	|	|	|	56	
348	—|	|	—|	1—3	—	—	—	—	—	—	—	—	15	41
349	|	|	|	|	|	|	|	|	|	|	|	|	56	
350	|	|	|	|	|	|	|	|	|	|	|	|	56	
351	—|	|	—|	|	—|	|	—|	|	—|	|	—|	|	53	3

mornings ; on Tuesday afternoon he went away at 3 o'clock, and remained away the rest of the week, making 15 hours and losing 41. The remainder of the numbers are recorded in a similar manner, and do not need special explanation. The figures from this register are carried to the record and compared with the figures from the stock sheets, and the amount of work executed. In the example, No. 346 is John Williamson ; his private record, 1374, is kept quite separate and private. This is preferably done by the card system, allowing of large numbers of minor accounts as these being kept in a small space. The record being described shews the department he is engaged in, and the rate of wage, and the debit and credit account shewing the result of his labour.

The debit side gives the hours lost and made and the wage received ; in addition to this a column may be used for fines or other charges, which, although really a credit, must be placed here to get the amount received. His credit would be the result of his work, and may be divided into the results from the use of material and the value of his labour. It might happen that a loss on his labour would be more than counterbalanced by the gain on his use of material. There is a profit and loss account, so that the value of his services could be ascertained at any time ; this will permit of the consideration of bonuses, or alterations in the rate of pay.

346. LABOUR RECORD.

JOHN WILLIAMSON,
27, Lawrence Street.

Department

F. Wage per hour, 6d. Private Record, 1374.

DEBIT.				CREDIT.			
Week ending	Hours. Lost.	Hours. Made.	Wage Received.	By Material.	By Labour.	Profit.	Loss.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	
October 16th ...	2	54	1 7 0	...	1 8 2	0 1 2	

Each department must have a ledger account shewing the total profit and loss on the working, but these totals are taken from department accounts, which should shew the details of the cost of labour, materials, and incidental department charges. The department account may be set out in the manner shewn, which represents the labour side of the working expenses of a team. In addition to the number and name of each person in the team, there are columns for each day, where the amount of work done by the operator is entered; these amounts are taken from the work slips to be described. There are also spaces for the entry of the total for the week, the wages received, and the estimated value of the work done, taken from the amount allowed in the prime cost.

This team consists of men engaged in different operations—as is the case in a lasting team. Three are engaged in similar operations, acting as feeders to the others; it is therefore important that the output of these be closely watched, because their product decides the amount of work done by the remainder of the team. In this instance one of the operators was 12 pairs short of the average output on Wednesday, although he is credited with wages representing full time. This drop in the number of pairs has prevented the team making a profit on the week's output, and demands investigation.

This account apparently balances, but really represents a loss on the working of the team unless the prices allowed for the operations include the cost of incidental expenses. This would be difficult to decide to a fine calculation, because the cost of supervision, rent, and light, are constant, and the number produced by a team varies; therefore, the amount charged the team should be added as a debit, and the team expected to earn sufficient to cover these charges, which are as much part of the cost of their work as their wages.

This should be set out as a debit and credit account, as all other accounts. The wages paid, cost of supervision, rent, power, machine charges, materials (stores) used, and light are the debits; the credit is the amount of work produced.

Week Ending October 16th, 1905. 1798.

Department D. Team 7.

No.	Name.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Wages. £ s. d.	Pairs.	@	Value. £ s. d.	Profit. £ s. d.	Loss. £ s. d.
327	Watson J.	60	60	60	60	60	40	1 8 0	340	1d.	1 8 4	0 0 4	...
328	Kay W ...	60	60	48	60	60	40	1 8 0	328	1d.	1 7 4	...	0 0 8
329	Clark G...	60	60	60	60	60	40	1 8 0	340	1d.	1 8 4	0 0 4	...
330	Wright H.	...	...	...	...	...	...	2 2 0	...	½d.	2 2 0	...	...
331	Emery G.	...	...	...	...	...	...	1 8 0	...	⅓d.	1 8 0	...	...
332	Adnitt F.	180	180	168	180	180	120	1 8 0	1008	⅓d.	1 8 0	...	...
333	Barker E.	...	...	...	...	...	...	1 1 0	...	¼d.	1 1 0	...	...
334	Snell W.	...	...	...	...	...	...	0 10 6	...	⅛d.	0 10 6	...	...
							Debit	£10 13 6		Credit	£10 13 6	0 0 8	0 0 8

Operators engaged on processes independent of other workers would have their account entered very much as the time record, or as the entries on the specimen team account; where the figures were already in the department account it would not be necessasy to enter more than the totals in the operators' record, and the reference number of the detailed account.

The figures for the compilation of the remainder of the labour, as cutters and packers, would be secured from the cutting and slip sheets as described on Pages 95 and 148.

Any method of organisation must be closely connected with the system of recording the details of the style, cost, and selling price of samples, and the receipt and execution of orders. The details of the materials and the method of construction may be classified as styles and referred to by the use of style numbers. This would make it necessary for practically all the management to be administered from the clerical department; as is common in America.

Materials would be represented by their folio number, and all other parts by the style, allowing of any combination of styles in different parts to make up a sample. By this method every department would have a Style Record Book, and in some departments practical specimens of the style.

The person writing out the work tickets for the factory would have the responsibility of entering and describing the style for each order, the foreman or workman being only responsible for carrying out the work to the style mentioned on the ticket. If this is used in addition to the case or ticket number and each process is marked, a perfect record is made of the value of the work executed by each operative and the person who is responsible for any process in the production of a certain case of goods.

By this method the first operation would be to classify all operations and identify them by numbers; this being completed, the sample book would consist of a number followed by the style number of all parts and the recoguised folio number of the materials used. A portion of this sample page would be as shewn :—

Sample No.	Pattern (Style.)	Legs.	Flys.	Facing.	Vamp.	Counters.	Cap.	Joiner.	Backing.	Lining.	Front Lining.	Fly Lining.	On Facing.	Strap.	Loop.	Side Lining.	Materials per Dozen.
227	34	231 10/-	...	...	254 11/-	..	254 4/-	92 1/-	...	807 5/6	...	...	...	807 1/-	334 10d.	49 3d.	£1 13 7
228	42A	109 8/-	...	942 2/6	69 7/-	73 3/-	69 3/6	93 9d.	97 1/6	106 3/6	808 6d.	...	...	806 9d.	334 10d.	50 4d.	£1 12 2

In the case of the upper department, it would simplify the system by having a style number for the patterns and arranging all the parts cut to that set to have the same number. Where provision was wanted for slight deviations it could be provided by adding a letter—as 42a may represent the number of the patterns and ascertain shape cap, other deviations being identified by other letters. This could be extended to all other departments, so that all common deviations from a standard style could be easily referred to.

The specimen given shews the cost of the materials in samples 227, 228 ; this being extended to other parts would allow of the cost of any section being ascertained. A customer wishing to have a top as 227, instead of 228, could be advised of the difference in the cost immediately.

The style for the departments could be grouped in a similar manner ; that is the general style would have a number and deviations would be registered by letters. For instance, ordinary McKay sewn close welt bottoms might be style 1, the same with full welt 1a, with half wide welt 1b, and so on. In some departments the style numbers would cover all the description required, the labour being the most important matter ; in others the materials used would be the dominating factor, and therefore in the clicking and the bottom stock rooms the styles would be set out much as the specimen of the sample book.

If the orders were sent through complete or divided into convenient numbers and the divisions referred to as case numbers, and this number stood for all sub-divisions of the work tickets, the person that performed any operation on any particular boot could be identified. As it is, if a large order is sub-divided by the foreman of a shop and several different persons perform similar operations, it is difficult to discover the person who may have done bad work.

The usual work ticket is divided into sections, that represent each department ; each of these sections being marked with the order number, ticket number, pairs, and sample number. As mentioned before, a closer method would record the case number. A specimen of this class of ticket is illustrated—see Work Ticket. The use of this ticket makes it necessary that an account of each sample be recorded in each department, and that a special description be written on each ticket. It is not certain that it would not be more economical in point of time employed that the style number be placed in each section instead of this extended written description. The perforated slips are torn off by the foreman of the department as the work is passed through and used as vouchers for work done. These vouchers should be given in at least once a day, and entered on the log. (See specimen.) By the use of this log the progress of the work through the factory can be traced, and any order, or portion of an order, located.

This log should be entered up at least once each day, and as the blank spaces make it evident where there is any stoppage, the cause of any order being delayed should be inquired into. Where it

is desired that an order, which contains several different items, should go through under one number, the different lines can be divided by added letters, as shewn. This log records the despatch of orders 795-6-7. 798 contains several distinct lines, which are identified by being marked as described. It is seen that the line 798c has reached the rough stuff cutters, but appears to have stopped there.

LOG.

Order No.	Office. Date.	Clicking. Date.	Stitching. Date.	Rough Stuff. Date.	Bottoming. Date.	Finishing. Date.	Dressing. Date.	Packing Date.	Despatched. Date.	Per
795...	15/11	17/11	20/11	22/11	24/11	25/11	27/11	28/11	29/11	L.N.W.
796...	15/11	17/11	20/11	23/11	25/11	26/11	28/11	29/11	29/11	G.C.
797...	15/11	18/11	20/11	23/11	25/11	26/11	28/11	29/11	30/11	M.
798...	16/11	18/11	21/11	23/11	24/11	25/11	28/11			
a...	16/11	18/11	21/11	23/11	24/11	26/11	29/11			
b...	16/11	20/11	23/11	25/41	27/11	28/11				
c...	16/11	20/11	27/11	29/11						
d...	16/11	18/11	22/11	25/11	28/11	30/11				
e...	16/11	19/11	23/11	25/11	27/11	28/11	29/11			
799...	16/11	19/11	23/11	25/11	27/11	28/11	30/11			
800...	16/11	19/11	23/11	25/11	27/11	28/11	30/11			

The work ticket, if made out in the complete order for the one line, and if in too large a number for one operator, has to be divided by the foreman of the department. Several very small lots may be grouped to form a lot of a number that will be convenient. This is done by the use of supplementary tickets—as marked departmental ticket. The operative tears off the portion of the ticket that is connected with his process, and marks it with his number or initials. These tickets passed into the office act as vouchers for the payment of piece work, or for the making up of the labour record. The arrangement of the spaces depends on the department, but in any case, the processes are commenced at the bottom, and divided by perforations, so that as they are torn off the portion remaining is attached to the work or the rack.

[*For specimens of Work Tickets, see next page.*]

WORK TICKET.

Ticket No................ Date...................

Workmen losing this Ticket will be fined 6d.

Order No.	Pairs.	Sample No.	Qual.	Subs.	Heel.	Slugg	Finish.

Description.

Make.

Fitting.	2	3	4	5	6	7	8	9	10	11	12	13	1

FINISHING.

Order	Ticket	Pairs	Sample

HEELING.

Order	Ticket	Pairs	Sample

BOTTOMING.

Order	Ticket	Pairs	Sample

LASTING.

Order	Ticket	Pairs	Sample

TOPS AND STUFF.

Order	Ticket	Pairs	Sample

ROUGH STUFF.

Order	Ticket	Pairs	Sample

CLOSING.

Order	Ticket	Pairs	Sample

CLICKING.

Order	Ticket	Pairs	Sample

DEPARTMENT TICKET.

No.................... Prs.................

HEEL COMPESSG. Pr 1	SLUGGING. Pr 1
HEEL ATTACHG. Pr 1	TRIMMING. Pr 1
STITCH PRKG. Pr 1	HAMMG. OUT. Pr 1
SCREWING. Pr 1	STITCHING. Pr 1
SEWING. Pr 1	SOLE LAYING. Pr 1
GETTING OFF. Pr 1	TACKG. ON STUFF. Pr 1
TAPPING UP. Pr 1	LASTING. Pr 1
	TACKING ON. Pr 1

The prime cost of the finished goods is practically an estimate of the probable cost of production, based on figures produced by the production of similar goods, or by experiment with the object of getting the particular estimate. This prime cost is sometimes referred to as the nett cost, because it represents the cost of manufacture ; the estimate for distribution, profit, and risk, being distinct and additional. In an established business, the figures upon which the prices are based, should be taken from a record of cost of production ; this record consisting of a tabulated set of figures compiled from the cutting sheets and departmental returns, and representing the cost of materials and labour for all details of manufacture.

The particular manner of setting this out is of minor consequence so long as the quality, materials used, and the style and cost are clearly shown. It will be sufficient, in the materials record if the folio number of the material, and the cost of the part are entered, by referring to the folio all information required regarding the cutting sheets, etc., can be secured.

SPECIMEN OF RECORD OF COST OF SECTIONS. BOX CALF. 1ST QUALITY.

DESCRIPTION :—Lace boot legs—Style 268—Area of pattern 118 in. per pair—
Average cutting surface per pair 130 in.

Fol. No.	173	498	225	647	932	543	724	836
Cost ...	d. $10\frac{1}{8}$	d. $10\frac{1}{4}$	d. 10	d. $10\frac{1}{4}$	d. $10\frac{1}{8}$	d. $10\frac{1}{3}$	d. 10	d. $10\frac{1}{4}$

This record is the best indicator of the cost of materials and guide to deciding the advisability of alteration in the selling price. It represents the actual cost of production, and is far more reliable than figures produced by estimates of experiments, or mere matters of opinion. It should form the basis of the prices given in the prime costing.

The labour records should be set out on a similar principle ; the figures would be compiled from the weekly returns of the departments, and would represent the actual cost of labour over some period and by particular processes. These returns are of great value in the determination of the value of different systems of manufacture, or of machinery purchase. They are the brief statements of results, which, by comparison between the different departments, the effect of systems on the whole product of the factory can be ascertained.

It sometimes happens that the practical mind is prejudiced against certain methods, and does not carefully view the whole matter at issue. These figures represent a broad statement of the working of the business, and shew the influence of the methods on the different departments ; a gain on one section may result in more than a corresponding loss in another, or *vice versa*. These records disclose it at once.

SPECIMEN RECORD OF COST OF LABOUR.

DEPARTMENT D. :—M.S. Lasting and Attaching ; Men's leather lined, medium substance. Style 10.

DESCRIPTION :—Lasted by team, method G, McKay sewn, middle and sole delivered blocked and fastened. Delivered channels down, heeled and slugged.

Week ending	6/11/05	13/11/05	20/11/05	27/11/05	4/12/05	11/12/05	18/12/05
Cost per dozen	5/4$\frac{1}{8}$	5/4$\frac{1}{8}$	5/4$\frac{3}{16}$	5/0$\frac{1}{8}$	5/4$\frac{1}{8}$	5/4$\frac{1}{8}$	5/4$\frac{1}{16}$

This method should be carried out for each of the departments, and the average cost found ; the results of all the departments, with the average cost for comparison, should be prepared each week, so that any fluctuation would be detected, and its cause enquired into.

The result of these records give the data upon which the estimate of values for the prices quoted in the prime cost are based. The actual method of setting out the figures for particular samples is not important. Some prefer a separate page for each sample, the items being arranged in a vertical line, with a description at the head. It is probable that the description would be more conveniently placed in a separate book, and that of the various selling prices in a sample price book.

This would be set out much as the specimen illustrating the cost of uppers, but would be carried out for all other parts. The total of these would represent the prime or nett cost ; the selling price would include this, and the additional charges which would be peculiar to the method of selling.

The selling price is naturally based on the prime cost, but varies with the conditions under which the sales are effected. These conditions may include all matters from the time the goods are in a saleable condition, and may even include the cost of cartons ; that is a mere matter of detail peculiar to particular cases. In all calculations the most important matter is to include all items of expenditure under the proper headings, and not to merely lump a certain percentage on the prime cost.

Travelling expenses are simply the cost of sales, and should be made a separate account, and kept as all other accounts ; the cost will vary between one per cent. for wholesale accounts, which may include disbursements not actually travellers' expenses, to seven per cent. for collecting small orders on widely scattered ground. With this additional cost of securing orders there is also generally additional risk, which should be added exactly as other items.

Discounts also vary with the length of credit ; buyers for prompt cash usually expect 6¼ per cent., and also usually get it. The discounts for other periods are matters of business arrangement, personal to each manufacturer, as is also the question of the amount of profit, the discussion of which would serve no useful purpose in a work of this character.

The total selling price therefore varies with the details of the business methods after the actual manufacturing processes are finished ; the expert discussion of these matters is to be found in many excellent works upon business routine. The subjects considered here in no way include all the details of the business side of shoe dealing, but it is hoped that it does contain enough to be some guide to the production of a working system adapted to the requirements of particular cases.

— FINIS. —

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